FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

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DIARY OF CURRENT AND FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—

1931

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Sept. 29. Junior Aero Club Schneider Trophy Dinner and Entertainment.
Oct. 3. Cardiff Ae.C. Air Pageant at Splott Aerodrome.
Oct. 3-4. International Gliding Competition, Balsdean, Sussex.
Oct. 8. Balloon Ascent, Lecture by Prof. Piccard before R.Ae S.
Oct. 15. "Protection of Metals in Aircraft Construction," Lecture by H. Sutton before R.Ae.S.
Oct. 27. "By Air to Baghdad." Lecture by Mrs. Pender Chalmers, at the Electrical Association for Women, 15, Savoy St., Strand, W.C.2 (3 p.m.).
Oct. 29. "Accidents in Civil Aviation," Lecture by Capt. A. G. Lamplugh before R.Ae.S.
Nov 5. "Safety in Spinning," Lecture by H. B. Irving before R.Ae.S.
Nov. 19. "Aircraft Vibration," Lecture by H. Constant before R.Ae.S.
Dec. 3. "Wheel Brakes and Undercarriages," Lecture by S. Scott Hall before R.Ae.S.
Dec. 10. "Air Flow—Demonstrations on the Screen by Means of Smoke," Lecture by W. S. Farren before R.Ae.S.
Dec. 17. "Control Beyond the Stall," Lecture by Dr. G. V. Lachmann before R.Ae.S.

1932

Jan. 14. "Interference." Lecture by E. Ower before R.Ae.S.
Jan. 28. "Effect of Height on Range," Lecture by A. E. Woodward-Nutt and Flt.-Lt. A. F. C. Scroggs before R.Ae.S.
Mar. 10. "Results with the New Wind Tunnel at N.P.L.," Lecture by E. F. Relf before R.Ae.S.

EDITORIAL COMMENT

Interceptors on the Coast

ACCORDING to a recent Air Ministry weekly order, No. 25 (Fighter) Squadron will before Christmas be re-equipped with the "Fury" interceptor fighter instead of the "Siskin." No. 25 F.S. is a very fine squadron, and well deserves the honour. We congratulate Squadron-Leader H. M. Probyn, D.S.O., and his pilots. We are sure that they will make a fine showing with the "Fury." Somehow we can never think of No. 25 as flying anything but "Grebes." Our mind always goes back to the days when Squadron-Leader Peck commanded No. 25 F.S., and in two consecutive Hendon displays showed us the pitch of perfection to which it was possible to bring squadron evolutions in the air. The standard then set by No. 25 F.S. was not, in our opinion, equalled until the Display of 1930, when No. 43 F.S. reached an equally high stage of accuracy. Perhaps it is only a coincidence that these two squadrons are the first two selected to receive the "Fury" interceptor.

If it seemed probable that it was the merits of these two squadrons which has been the cause of their selection for this honour, there would be little to say about the matter except to offer them our congratulations. But they have one other point in common besides their merit. They are both stationed on coast aerodromes. There are only two coast aerodromes belonging to the Fighting Area, namely, Tangmere, near Chichester, and Hawkinge, near Folkestone. No. 43 lives at Tangmere, and No. 25 at Hawkinge. The course of events, therefore, inevitably suggests that it is the location of these two squadrons rather than their merits which has been responsible for their selection as interceptors. At first seeming, it is the natural thing to place interceptor squadrons on the coast. They are the only squadrons which have any chance at all of climbing up to engage raiding bombers at the point of entry into England. The "Fury" aeroplane is specially designed to climb at a phenomenally fast rate, and to reach its greatest efficiency at

a great altitude. The chain of argument seems obvious. The ideal form of defence, once a raid has got into the air, is to attack it before it has reached England, or at least before it has travelled far over English soil. Therefore aerodromes are placed on the coast. The next thing is to provide the squadrons on those aerodromes with special interceptor fighters, so that they can act on the very shortest warning. This describes the actual sequence of events. Only one thing remains to complete the proof that our suppositions are correct, and that is the selection of the third interceptor squadron. Hawkinge harbours only one squadron. Tangmere is the home of two; Nos. 43 and 1 F.S. If the next squadron selected for re-equipment with the "Fury" should prove to be No. 1 F.S., the proof will be complete that it is the geographical position of the aerodrome rather than any other consideration which has been in the mind of the authorities of Air Defence of Great Britain.

The question is whether the coast is tactically the correct place to station interceptors. We expressed some doubts on the subject when No. 43 was first selected to receive "Furies," though we looked for the Air Exercises to provide something like an answer on this point. Exercises or manœuvres, we are well aware, are always artificial, and to draw a lesson from them it is necessary to rule out the artificial elements so far as is possible, and to make allowance for factors which cannot be present, but which would play a part in real war. In the exercises this summer, one of the most striking points was the regularity with which the two squadrons of "Hart" bombers were able to cross the coast in the neighbourhood of Tangmere without any interference by the "Furies." In Exercises the raid has to be spotted and reported by coast watchers. The report has to go up to the Headquarters of the Fighting Area, and the latter has to send an order to the interceptors to take off and climb after the raiders. However rapid the communications may be, this all takes time, and the "Harts" can cover a lot of country in a very few minutes. Almost invariably they had got out of striking distance before the interceptors were ordered off the ground. It would seem that this was inevitable, and that after one or two cases there was no profit in following a course of action which had proved futile. The interceptors sometimes caught the raiders on their return journey, which is useful, but is not intercepting.

The lesson would seem to be that interceptors ought to be stationed farther inland, if they are not to be entirely wasted. It is therefore interesting, if not surprising, to see that the A.D.G.B. command is persisting in the policy of stationing them on the coast. Perhaps the reason may be that A.D.G.B. is taking into account the probable conditions of real war. Then, the raids will start, not from Andover, but from some Continental aerodrome. Our secret service agents may be counted upon to give warning in a certain number of cases of the start of a raid. It must be very difficult to get information across with sufficient promptitude to be of much service, and probably too much reliance should not be placed on this source of help; but it may work in some cases. In the second place ships at sea may send warnings of raids in the air. This source of information also seems somewhat uncertain. There may be other factors which are kept secret. Adding all the known factors together, it would seem probable that in actual war a number of raids would be over the heads of the coast aerodromes and away inland before the interceptors would be able to bring the bombers within their gun-sights.

In this game of the air defence of London, minutes are of vast importance. Interceptors stationed at Biggin Hill in Kent, at Kenley in Surrey, and at North Weald, or some other spot, in Essex, would have an excellent chance of performing their true duty of intercepting. Coast aerodromes appear chiefly useful for inflicting damage on raiders as they fly homewards, and standard fighters should be amply good enough to undertake that work. To station interceptors on the coast has so far proved to be an almost complete waste of the marvellous qualities of the "Fury" aeroplane.

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R 100

In days of financial crisis we are all obliged to do and suffer many things which we dislike. The position recalls a scene in the film "Dirigible," when a heavily laden Fokker was endeavouring to climb the mountains which surround the South Pole. The pilot, intent only on the matter in hand, kept calling out to his men to throw overboard another bag of food, so as to lighten the aeroplane. The Antarctic explorer in the party objected to seeing the food thrown away, for he knew how badly it might be needed later on. Nevertheless, it had to go, or the machine would never have surmounted the pass. Afterwards the food was needed very badly indeed.

In order to get over our present steep pass we are throwing away a number of things which we may need very badly later on; but it is useless to protest. Among these things is the airship R100, and pretty well all that remains of our airship experiment. There are, it is true, some people who will actually be glad to be rid, for the time at any rate, of the whole airship business. On the other hand, the recent decision of the late Government to carry on airship research in a modest way, waiting until the German and American programmes should prove more than has yet been proved about the value of airships for commercial or naval work, was generally approved by the leading men in Parliament of all parties, and, we believe, by most thoughtful people in the country. In our present straits, airship experiments are in the category of things which we *can* do without, and so one which we *must* do without. It may well happen in the future that we shall take up the matter again, and then we shall have to spend vastly more than would now be needed to keep the experiments going. It may be that perhaps then we shall be better able to afford a large sum than we can afford a small one now.

8,000 MILES IN A FLYING BOAT

THE SARO A.7 FLYING BOAT: A three-engined (Bristol "Jupiter") all-metal flying boat which has just completed a cruise of 8,000 miles.

A SPLENDID performance, including a test cruise of **8,324** miles and a non-stop flight from Gibraltar to Mount Batten, Plymouth (a distance of **1,230** miles), was completed on September **16** by a R.A.F. flying boat constructed by Saunders-Roe, Ltd., of Cowes.

The machine, a **1,500**-h.p. sesquiplane, styled the "Saro 7," carried a crew of six, under the command of Flt. Lt. C. H. Cahill, and was one of two new flying boats submitted to the Air Ministry as a possible intermediate type between the twin-engined and large 2,100-h.p. three-engined boats at present used by the Royal Air Force. In accordance with normal practice, the official trials of these machines concluded with a long-distance cruise under service conditions, and the route selected, from England to Port Sudan, gave opportunities to study the behaviour of the craft in tropical waters.

The cruise totalled **8,324** miles, and was accomplished without trouble between August **15** and September **16**. From start to finish the flight proceeded mainly by a series of long hops, seven of the stages exceeding **600** miles in length. At Algiers the boat successfully rode out at anchor a gale of extreme severity.

The progress of the cruise is tabulated below. It will be noticed that halts of some duration were made at Malta, Aboukir, Algiers and Port Sudan; these represent in the main periods spent in local trials.

For the final two hours of the flight from Gibraltar to Plymouth the boat flew on two engines only, a feat which demonstrates ample reserve of power and a large factor of safety.

The "Saro **7**" is a flying boat developed primarily for service use by Saunders-Roe, Ltd. It is fitted with three air-cooled geared radial Bristol "Jupiter" motors, carried in nacelles just beneath the top plane, and was designed for open sea and coastal reconnaissance work. The machine is constructed throughout of metal, and weighs, with full load on board, more than **24,000** lb. From wing-tip to wing-tip the upper plane measures **88** ft., and the greatest height is two inches less than **19** ft.

Date	Distance in land miles	Place of Departure and arrival	Flying Time h.	m.
Aug. 15	319	Felixstowe-Plymouth ..	—	
,, 17	457	Plymouth-Hourtin	4	29
,, 18	356·5	Hourtin-Berre (Marseille) ..	3	36
,, 19	750	Berre-Malta	7	25
,, 22	966	Malta-Aboukir	9	20
,, 28	1,073	Aboukir-Port Sudan	9	5
,, 31	883	Port Sudan-Lake Timsah ..	10	45
Sept. 8	201	Ismailia-Aboukir	2	15
,, 9	966	Aboukir-Malta	13	2
,, 11	655·5	Malta-Algiers	9	56
,, 15	467	Algiers-Gibraltar	3	30
,, 16	1,230	Gibraltar-Plymouth	13	40

Total distance, **8,324** miles. Total flying time (approx.) 90 hrs. Average speed, 92·5 miles an hour.

GIBRALTAR—PLYMOUTH NON-STOP: Another view of the Saro A.7 which concluded its 8,000-mile cruise with a non-stop flight from Gibraltar to Mount Batten.

THE THREE-KILOMETRE RECORD

On September 16, Flt. Lt. Stainforth went up in the Vickers Supermarine Rolls-Royce S.6B., S.1596, to test a different type of Fairey Metal propeller. Considerable test work has already been done with various types of propeller, first for the Schneider course, and also for the 3-kilometre record. The pilot brought the machine down on the water with his usual skill, and was running off its speed, when his heel caught in the rudder bar. The machine was stated to be skidding to the left, and the pilot was correcting this, when this sudden involuntary upset to the steering caused the machine to swing violently to starboard, and it capsized. Stainforth pressed the quick-release pin and freed himself from his harness, got clear, and came up to the surface. His nose was cut somewhat badly, but otherwise he was no worse for his adventure. He refused to go to bed, and, after having his cut treated, he changed into civilian clothes and returned to the seaplane station, to watch the salvage operations.

The seaplane sank while it was being towed back to Calshot. Divers went down and spent many hours securing it with cables, and next day it was hauled to the surface by the derricks on the naval salvage ship. It was found that one float was damaged, and also the cockpit, but that otherwise the machine was intact. It was taken off to the Supermarine works for repairs.

It has since then been decided not to use the specially "boosted" engine which had been prepared for the attempt on the 3-kilometre record. It is stated that the Air Ministry has taken this decision in order to avoid any unnecessary risks. In all probability another attempt to improve the record time will be made towards the end of this week, using S.1595, the machine in which Boothman flew the Schneider course, with an ordinary Schneider-type engine, but with a propeller specially selected for the task. The general opinion seems to be that Stainforth's accident will not prevent him from flying the machine on this attempt.

The Value of the Schneider Stimulus

As might be expected, several letters have appeared in the Press regarding the utility of the Schneider Contest. In the ordinary course of events, such diatribes as put out by Mr. Mark Howley in the *Daily Telegraph* and others are, by reason of the ignorance displayed, unworthy of notice. But in this instance it is to be welcomed, as it has done good by enabling Mr. A. F. Sidgreaves, Managing Director of Rolls-Royce, Ltd., to reply—as given below—and to expose the narrowness of the views taken by so many writers "to the Editor."

Mr. Sidgreaves replies, under date September 15, as follows:—

Sir,—Referring to the letter from Mr. Mark Howley, I am sure there are many people like him who wonder what value the Schneider Trophy race really is. They do not realise that it is not a mere sporting event, but the most valuable form of practical aeronautical experiment.

The loss of lives is deeply regretted, but history shows that scientific progress has always demanded such sacrifices. It is really an overload test, and we can reproduce more quickly and more economically failures that would happen in tests of two or three hundred-hour duration.

As a result of the test this year, for instance, all the main components of these engines have undergone a definite improvement, and in consequence the life of the standard engine in service will be much longer than it would otherwise have been. Prince George recently pointed out this value of speed attempts in a visit to the Rolls-Royce works.

The second chief advantage is the amount of information obtained in the matter of the design of such components as, for instance, the supercharger. Valuable lessons have been learnt, too, in the reduction of wind resistance.

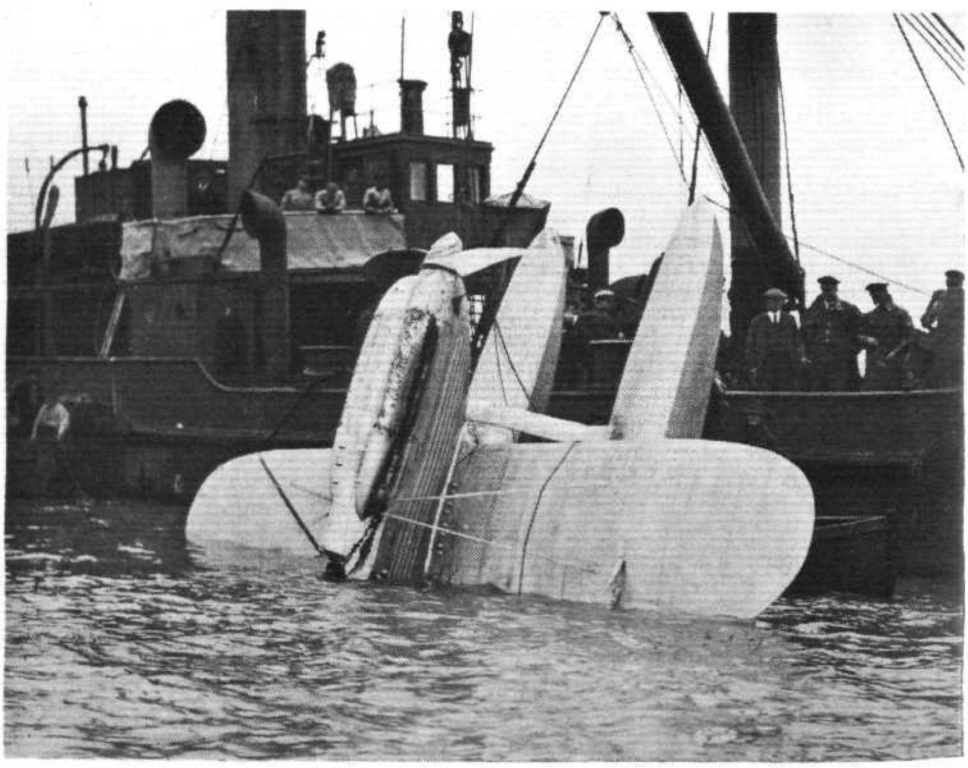
From the development point of view, the Schneider Trophy contest is almost an economy, because it saves so much time in arriving at certain technical improvements. It is not too much to say that research for the Schneider Trophy over the past two years is what our aero-engine department would otherwise have taken six to ten years to learn. This applies to all kinds of items to do with the engine, from sparking-plugs to fuels. Here we have made very considerable advances in knowledge. Much of what we have learned is capable of application to our chassis.

For the last few years Britain's supremacy in the manufacture of aircraft is generally recognised, and is due to the experience and knowledge gained in contests such as the Schneider Trophy.

The money paid by Lady Houston is not merely helping Great Britain to keep the trophy; it is helping us to improve British aviation and retain our supremacy in the air.—Yours, etc.,

For Rolls-Royce, Ltd.,

A. F. Sidgreaves, Managing Director.



NOT A SUBMARINE—BUT SUPERMARINE: Salving the Vickers-Supermarin S.6B from Southampton water, little the worse for its ducking.

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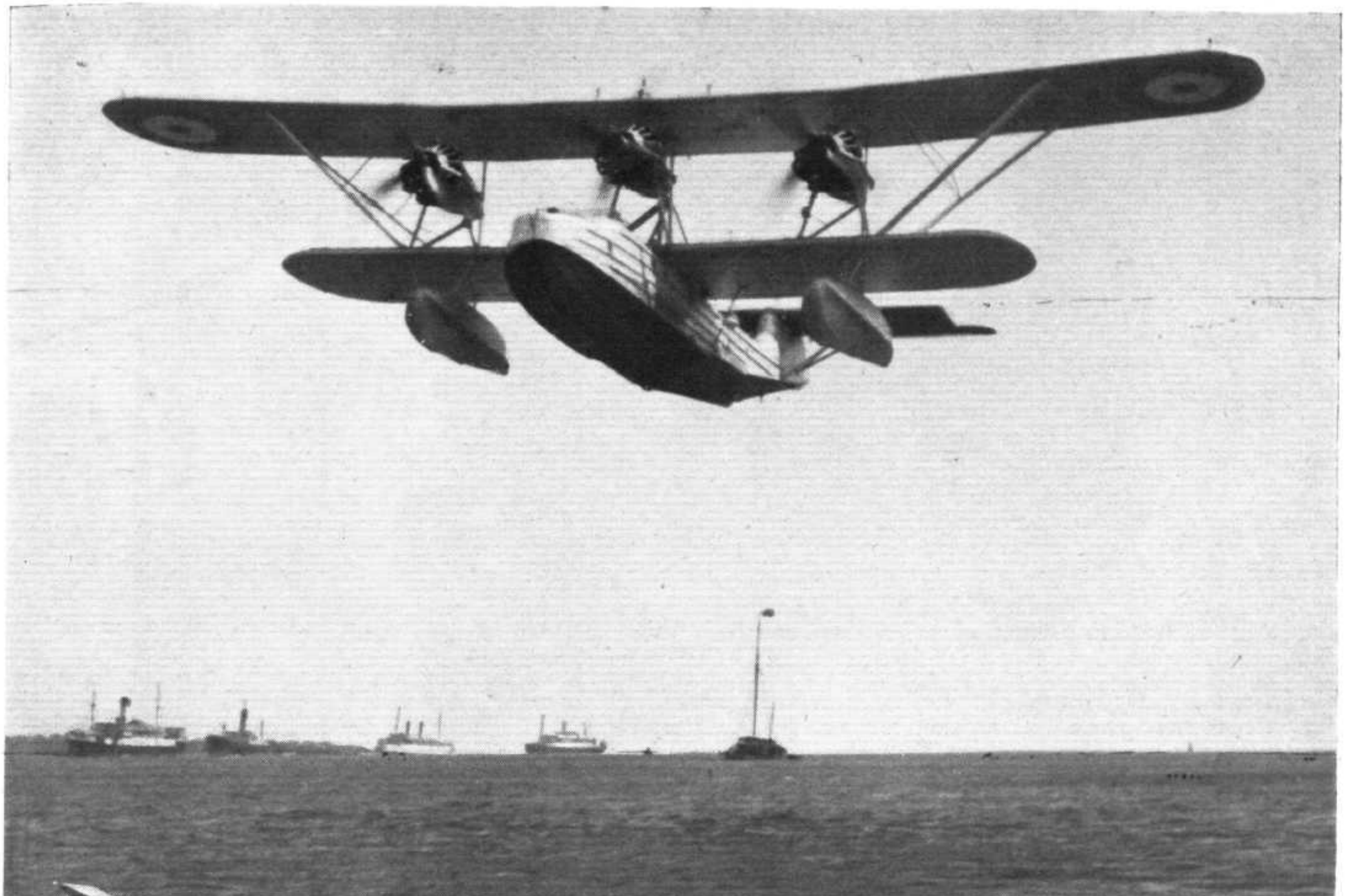
340.08 m.p.h. and not 348.08 m.p.h.

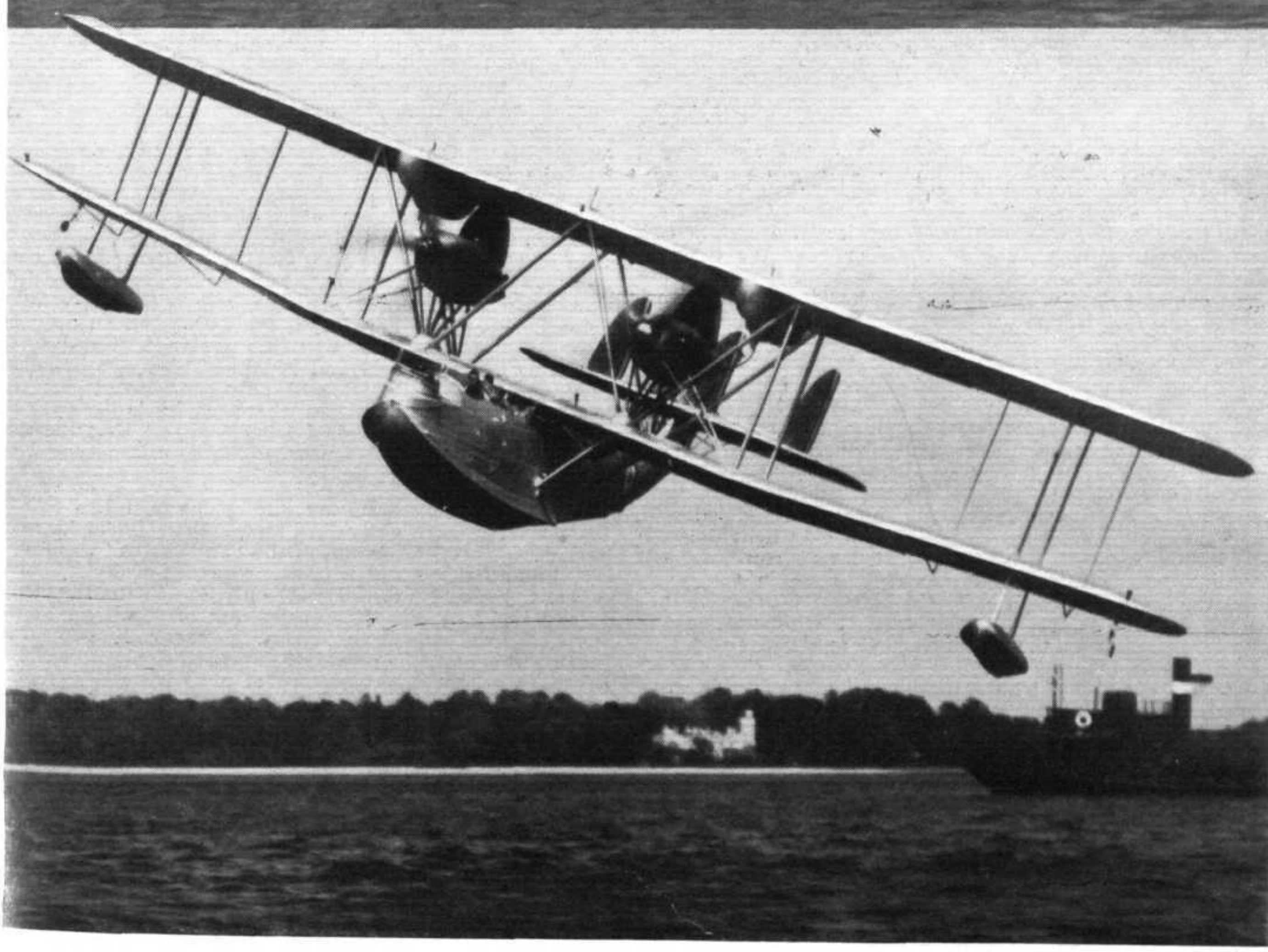
On page 933 of last week's issue of Flight the last figure in the table of speeds of Boothman's S.6B was wrongly given in a number of copies as 348.08 m.p.h. This should have read 340.08 m.p.h. The error was not discovered until a few thousand copies had been printed, but it was then corrected and the greater part of the "run" contained the correct figure. Will those of our readers who wish to have their copies accurate, and who happen to have received one of the early copies with the incorrect figure, please make the necessary correction.

Gibraltar Airways, Ltd.

Gibraltar Airways, Ltd., on September 21, started a passenger service by air (twice daily) between Gibraltar and Tangier.

NEW WINE IN OLD BOTTLES





Two Supermarine flying boats with new power plants. Above, the Southampton Mark X with 3 Bristol "Jupiters." Below, the ordinary Southampton, but with two Rolls-Royce "Kestrels."

DE HAVILLAND "MOTHS" IN THE ARCTIC

One of the "Moths," equipped with ski undercarriage, which was used by the British Arctic Air Route Expedition in Greenland.

IT will be remembered that the British Arctic Air Route Expedition—which has recently returned from surveying the possibilities of air routes in the Arctic—took with them two de Havilland "Moths." The de Havilland Aircraft Co. have received an interesting letter from the pilot who was in charge of these machines regarding their behaviour. We have received permission to publish this letter, which, it will be seen, is in the main extremely favourable, and shows beyond doubt the definite use of light aircraft on such expeditions. The letter runs as follow:—

"With reference to two 'Moth' aircraft used by the British Arctic Air Route Expedition, I have much pleasure in sending you a few notes on the behaviour of these aircraft under Arctic conditions, where they were used with every success for thirteen months.

"1.—*Engines.* The two Gipsy I engines ran perfectly throughout, summer and winter. It must be clearly understood that when flying over the ice-filled waters of East Greenland during the summer, or over the rough, windswept surface of the Inland Ice in the winter, a single engine failure would of necessity mean a crash, with serious results. Never once did the engines cause the least anxiety.

"No trouble was ever experienced in starting the engines, even in the coldest weather, as the special heating device supplied proved entirely satisfactory. The blow-lamp was used for about 20 minutes, after which the engine would start in the normal manner. After a run on the ground of approximately the same time, it could be opened up with scarcely a splutter, and, once in the air, would run normally for as long as the petrol lasted.

"There was one slight defect that came to light during the winter, but this was soon located and rectified. A certain amount of vapour is bound to form in the pipe from the crankcase breather to the bottom of the cowling. In the extreme cold this vapour froze, blocking the pipe. The result was that the engine started to throw out a lot of oil. Once the cause of this excessive loss of oil was located, the pipe was removed, and no further trouble was experienced. I think that this point is worth noting in case 'Moth' aircraft are wanted for any further expeditions of this sort.

"Only one other suggestion is offered, which is that a bar should be placed across the top of the oil filler cap to simplify the removal of the same, and also that it should be attached to the engine by a short chain. The reason for this is that the filler cap is not easy to remove from the engine when the 'Moth' is rigged as a seaplane, and that being the case, might easily be dropped overboard.

"2.—*Aircraft.* Apart from gales wrecking one aircraft and damaging the second, very little trouble was given by them. It was only the fact that they were easy to repair that enabled us to keep one aircraft in action throughout the year, with the exception of only twenty days. There was no trouble from controls freezing up, and all instruments worked well. There was, however, one more or less serious defect that we were unable to rectify, and which limited our flying to known landing places where the surface was absolutely smooth. This was that after the aircraft had been exposed to temperature of about Zero F., for some time the shock-absorbing legs of the undercarriage became solid and remained so throughout the winter. I can offer no suggestions on the subject, but, obviously, it is a defect that must be rectified. The skis were not entirely satisfactory, as a large amount of the flying had to be done from bare ice, which has a surface similar in every way to concrete, being as hard and rough. The result was that they wore very rapidly, and only just lasted out the winter. For flying at places where sea ice is likely to be used as a landing ground, I would suggest that the skis should be metal shod. On snow the Canadian type were very satisfactory.

"3.—*Conclusion.* In conclusion, I would like to say that, though of slightly less power than I should have liked, the general behaviour of the two 'Moths' was excellent, and all that could have been expected of any aeroplane of the type and power. It was only due to the simplicity of construction, and consequent ease of repairs, that we were able to keep them in service practically without a break throughout the period of the expedition, and enabled us to carry out a programme of air survey and reconnaissance never attempted before in Arctic exploration, and to carry it out as planned in England before the Expedition left."

Prof. Piccard's Next Attempt

ACCORDING to the Brussels Correspondent of the *Daily Telegraph*, Prof. Piccard, who rose to a height of nearly ten miles in a balloon in May of this year, is preparing to make a new ascent into the upper atmosphere. He is considering applying to the Fonds National des Recherches Scientifiques, which financed his earlier venture, for a new grant. The attempt, it is expected, will be made during next summer. This time the balloon will carry a Belgian pilot and a Belgian doctor, in order that the new height record shall be purely Belgian. He hopes to attain an altitude of over 16,500 m.

Parachute Dept. Please !

YOU may now buy your parachute over the counter. Selfridge's, the famous stores in Oxford Street, have become the sole distributors of Irvin Air Chutes in this country, except for the parachutes produced by the Irving Air Chute Co. for the Royal Air Force.

RECORD ENGINE SPEED INDICATORS

THE RECORD ELECTRICAL COMPANY was founded in 1911 to manufacture electrical measuring instruments of an improved type, invented and patented by Mr. J. W. Record, the founder of the company which bears his name. In recent years, in collaboration with the Air Ministry, the Record Electrical Co., Ltd., has developed electrical indicators (for aero engines) of an improved type, in which accuracy and long life are achieved by scientific design and high-grade workmanship in manufacture.

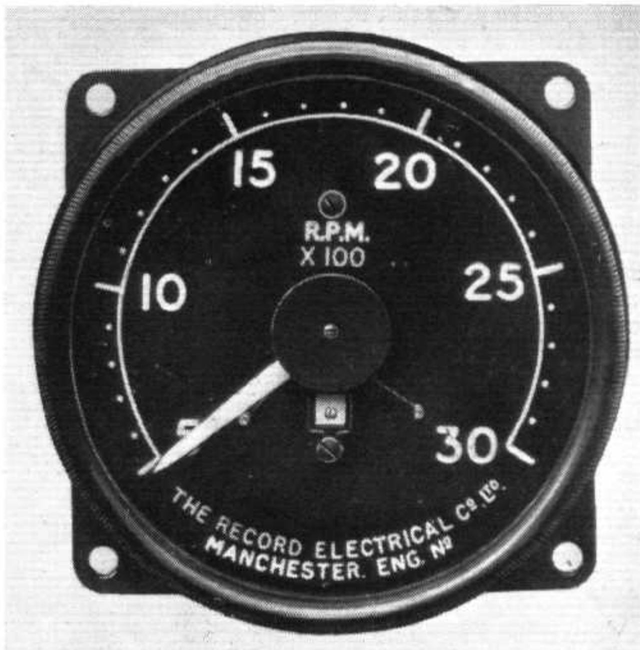
The electric type of engine-speed indicator scores over the mechanical type in that, when long distances separate the engine and the indicator, such as in very large aircraft with the engines placed out on the wings, for example, the mechanically-driven instrument needs a long drive which may be subject to considerable transmission stresses, which may cause jerky and inaccurate readings. The electric type, on the other hand, is independent of distance in that flexible electric leads only are needed to connect the engine and the indicating dial.

Various types of engine indicators are made by the Record Company, such as the normal "Cirscale" type of single indicator, the twin edgewise type of dual dial, and the triple edgewise type with three scales for three-engined aircraft. The working principle of all models is, however, the same in all types.

The Record engine-speed indicator consists of two parts, the dynamo or generator and the voltmeter or indicator. The generator is placed as close as possible to the engine to reduce the length of the drive, while the indicator can, of course, be placed anywhere in the aircraft, the distance being immaterial because the resistance in the leads is negligible. The indicator is a moving coil voltmeter of special construction, calibrated in terms of engine speed. Every indicator and every generator is standardised for use with any type of Record instrument. This is a considerable advantage, in that it reduces the number of spares which have to be stocked. For example, in a three-engined aircraft, a spare triple edgewise indicator would, but for this standardisation, require three spare generators, one for each dial. By accurate standardisation, one spare generator suffices, and will give accurate readings on any of the three dials. Moreover, the individual units of the edgewise type of indicator are themselves mechanically and electrically interchangeable, which again reduces the stock of spares. The "Cirscale" type of indicator is also interchangeable with the edgewise type.

The Generator

The generator is remarkably small ($6\frac{1}{4}$ in. by $3\frac{3}{4}$ in. by $4\frac{1}{2}$ in.), and yet is a real power unit, generating at 30 volts a current sufficient for the operation of high torque and high resistance indicators. The generator employs a cobalt steel magnet, in the field of which revolves a multi-pole armature running on ball bearings, and enclosed in an aluminium casing. A strong nose is fitted on the driving end, threaded to receive a standard British flexible drive. The armature shaft is connected to the drive by a floating coupling, so that no stresses are transmitted to the armature. The armature is standardised to give 30 volts at 3,000 r.p.m. For use when other than direct engine speed is used for the flexible shaft, gear wheels of suitable ratios are supplied, and the gear box is built into the generator in such a manner that the gears can be changed with very little trouble.

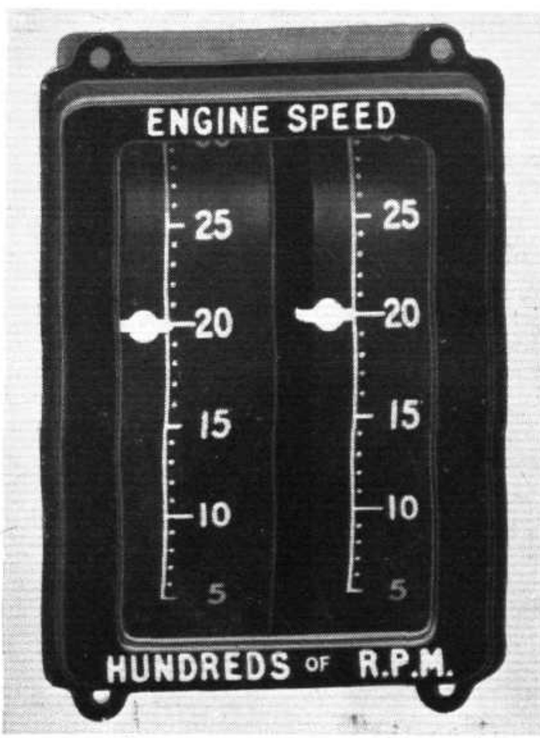


The "Cirscale" Type of Record Indicator.

During its tests at the works, the generator is first short-circuited while running at 3,000 r.p.m. Any subsequent accidental short-circuiting of the armature will not then upset the voltage. The voltage is then standardised by means of a magnetic shunt, which is afterwards locked. The armature is also adjusted so that afterwards it can be run clockwise or anti-clockwise without readjustment. Each generator is standardised to supply dual indicators. When one indicator is used, a resistance is put in circuit to represent the load of the other indicator.

The Indicators

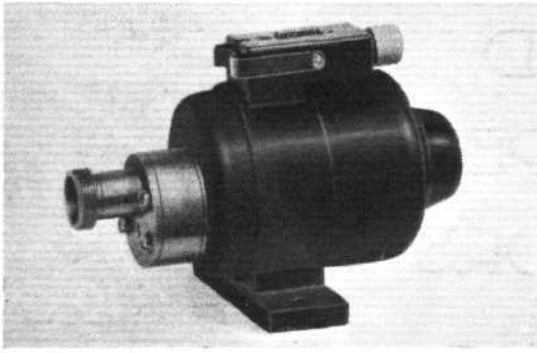
As already mentioned, two types of indicator are standardised, the single "Cirscale" type and the edgewise type. The indicator is a moving coil type of voltmeter of unusual construction, giving an angular deflection of the pointer of 300 degrees without gearing. The edgewise indicators are built up of single complete units, twin and triple indicators consisting of two and three units respectively, screwed side by side on a base. The Record Company recommends the use of two twin-indicators for four-engined aircraft, and two triple-indicators for six-engined aircraft. Each unit of these multiple indicators is so effectively screened that the removal of one indicator, or any interchange in position, does not affect the readings of the others. When placed 10 in. from a sensitive compass, a triple edgewise indicator does not deflect the compass more than 2 degrees. This deflection is not affected by the engine speed, and can be permanently adjusted on the compass-corrector magnets.



The Record Edgewise Twin Type of Indicator.

Weights and Dimensions

The size of the generator has already been given. The weight is but $2\frac{3}{4}$ lb., to which must, of course, be added the weight of the flexible drive. The "Cirscale" type of indicator measures $3\frac{3}{4}$ in. by $3\frac{3}{4}$ in. by $3\frac{1}{4}$ in. deep, and the weight is $1\frac{1}{4}$ lb. The twin edgewise type of indicator measures 5 in. by $3\frac{3}{4}$ in. by $5\frac{3}{4}$ in. deep. The weight is 5 lb. The triple edgewise type of indicator measures 5 in. by $5\frac{1}{4}$ in. by $5\frac{3}{4}$ in. deep, and the weight is 7 lb.



The Record generator for Electric Speed Indicators. The weight is only 2.75 lb.

For multi-engined aircraft it will readily be appreciated that the edgewise type of indicator is very convenient, as similar engine speeds are in line on the respective dials. Any drop in speed of one engine is noticed at once, which is not the case when three ordinary dials are used.

For further particulars, prices, etc., application should be made direct to the Record Electrical Co., Ltd., Broadheath, Manchester, or to the London office at Dacre House, Victoria Street, S.W.1.

THE ONTARIO PROVINCIAL AIR SERVICE

WE are indebted to the de Havilland Aircraft Co., Ltd., for the following information, gathered from the operational figures for the month of July in respect to the Ontario Provincial Air Service. In addition to what are termed "Suppression and Transport aircraft," the Ontario Provincial Air Service operates 21 light aircraft, all on floats, of which 14 are "Moths." For purposes of administration, the field of operations is divided into two districts, known respectively as the Eastern District and Western District. In the Eastern District 10 machines are employed, of which eight are "Moths," the other two being HS.2L, while in the Western District six "Moths" are employed, in addition to three HS.2L and two "Hamiltons." During the month of July the Eastern District machines compiled a total of 1,232 hours, 1,061 hours 5 minutes of which were flown by the "Moths." In the Western District the total time was 960 hours 5 minutes, including 520 hours 20 minutes on "Moths."

The report gives details of each day's operations, and the letters NFR (no flying required) appear dotted about. By the frequency of the letters NFR appearing, it seems that there has been much more forestry patrol required in the Eastern District than in the Western District.

Including both administrations, the greatest number of flying hours by any one machine was put in by one of the "Moths" operating in Eastern District at Sault Ste. Marie. This "Moth" compiled no less than 202 hours 45 minutes during the month. It flew on every day, the greatest time in a day being 10 hours 25 minutes on the 3rd, and the lowest 1 hour 10 minutes on the 28th. No mechanical trouble whatsoever was experienced with this machine, and it was flown throughout by one pilot. Reckoning flying time for machines in a descending scale, the first eight greatest times were put up by "Moths." The longest time in the air by any one machine in one day was 12 hours' flying, and this was done by the "Moth" with the second highest monthly total (191 hours 5 minutes), operating from the Bisco Base, which also flew on every day.

On the "Suppression and Transport aircraft" side, the air service operates various machines, including a three-year-old D.H.61 on floats. This machine heads the list for usefulness in this class. During the month of July it made 160 flights, totalling 150 hours 10 minutes; 51.1 tons of effective load were carried, as against 37.73 by the next on the list. In addition, 277 passengers were carried, as against 174 by the machine referred to above.

R.101 Memorial

The memorial to the victims of the R.101 disaster in Cardington Churchyard is now complete. The design takes the form of an altar tomb placed within a sunken enclosure approached by steps, and a relic of the vessel—the compass—built into the tomb. It cost £800, the money being raised by public subscription, and a few hundred pounds will be over for the financial aid to the dependents of those in whose honour the memorial has been raised. The memorial was unveiled, without any ceremony, on September 21.

The R.101 Memorial, over the grave of the 45 victims of the R.101 disaster, which was unveiled at Cardington on September 21

The Success of the Smoke Wind Indicator

The smoke type of wind indicator made by Dr. Ahrens, which was installed on the Aerodrome at Hanworth some few months ago, has proved such a success that inquiries for this type of indicator have been received by National Flying Services, Ltd., Feltham, Middlesex, from all over the world. One has only to land by the aid of such an apparatus once to realise how very much superior to the wind stocking it is. Not only is it absolutely accurate, since it may be placed out on the Aerodrome quite free from surrounding obstructions, but also it indicates the wind at the very place upon which one is going to land and not the wind away in some corner of the Aerodrome where there may be eddys and other false indications. It is very simple and cheap to maintain and at the same time compact, as will be seen from the description of the complete apparatus which appeared in Flight for June 5.

The Tern Glider P. 923

In Flight for September 11 we published a description of the Tern glider which has been produced and flown so successfully recently by Airspeed, Ltd. In the course of this description we mentioned that the design of this glider was the work of Mr. N. S. Norway. It has been pointed out to us that is not quite the fact. Mr. Norway and Mr. A. Hessell Tiltman are joint managing directors of this firm, after having been chief engineer and chief designer to the Airship Guarantee Co., during the construction of R.100. For the "Tern" Mr. Tiltman was responsible for the design work while Mr. Norway looks after the business, sales, and operational side of the firm. With two such well-known and able engineers in charge we expect their next aircraft, which should be out before long, to be of great interest.

THE AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

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CONTENTS

DEVELOPMENT OF THE HIGH-SPEED ALL-WING MONOPLANE.

By Dr. F. Wertenson.

The "All-wing" aeroplane has occupied the thoughts of designers for many years. Professor Hugo Junkers patented such a type in the very early days of flying. Hitherto no machine has been built, largely because it is necessary to go to very large sizes before the wing depth becomes sufficient to form a cabin with sufficient head room. The Uppercu-Burnelli Aircraft Corporation, of Keyport, New Jersey, U.S.A., has long been engaged upon research into the possibilities of combining a fuselage of aerofoil section with wings of orthodox design in such a manner as to attain a considerable percentage of the advantages of the "all-wing" type. An article on wind tunnel experiments on the Burnelli principle, by Professor Alexander Klemin, was published in The Aircraft Engineer *on August 29, 1930.*

In the following article Dr. Wertenson deals with the application of the Burnelli principle to a high-speed aircraft. The original Burnelli machine was quite successful, but it was not a fast machine. The coefficients in Dr. Wertenson's article are somewhat remarkable, but we have by us a photostat copy of a letter, signed by Professor Klemin, in which it is stated that the performance computations were made on conventional lines and with conservative methods, and that there does not appear to be a flaw in them.

Thorough investigation of the high-speed possibilities of the Burnelli monoplane verifies the contention that this plane is a practical application of the all-wing design to the need of the air transport industry for a high-speed airplane with heavy load capacity, and that its construction permits improvements in aerodynamic efficiency with an increase in size to meet the requirements of the future. The ideal all-wing type of airplane would incorporate only wing formation, utilising all power output for lifting purposes, there being no parasite drag. Fig. 1 illustrates the degree of power efficiency increase that would accrue if an ideal flying wing were practical. The power breakdown as applied to the Burnelli monoplane indicates that the wing horse-power required is 42 per cent. of the entire power required, which is indicative of the degree of flying efficiency that could be achieved by a wing only.

The size of airplanes will have to increase substantially before the wings reach such dimensions as to provide sufficient space for passenger accommodation without extensive wing distortion. This does not take into account other essential structural considerations at issue. For example, the thickness at the wing root of one of the largest cantilever thick wing designs with 96-feet wing spread is less than four feet. Assuming the same tail length and areas, the structural and accommodation difficulties without a fuselage are readily

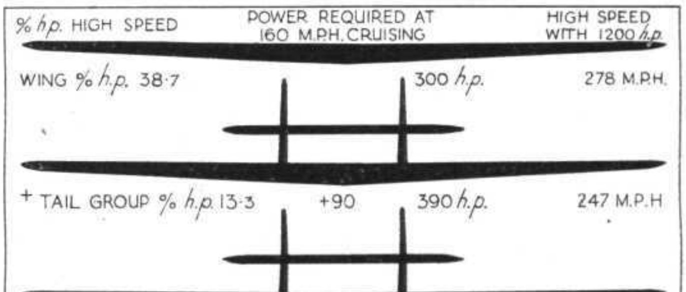


Fig. 1.

evident. In order to overcome these difficulties, some futuristic designs taper the wing extremely to achieve large wing ordinates on the centre section for necessary cabin height, and to obtain wing chord extension to facilitate tail group and tail wheel support. Despite the increased centre section, the resulting wing thickness is not sufficient to accommodate pilot and engines inside of the wing, and, with a view to obtaining the necessary space, airfoils of extraordinary thickness ratio are employed. Yet, withal, this design does not eliminate protrusions of cockpit and engine housing, which add further to resistance.

The Burnelli design is a compromise achieving aerodynamic advantage in combination with practical requirements. It consists of two wing panels of ordinary dimensions, attached to a centre section of considerable width for multi-engine installation, and sufficient chord to provide height to cover engines, cockpit and passenger cabin. Usual thickness ratios can be applied for the centre section as well as for the wing panels, and the frontal area of the plane is less than that of a flying wing with comparable accommodations. It also has important structural advantages. The body length provides favourable conditions for the installation of tail wheel and mounting of tail group. Windows can be arranged in the side walls below the wings, thus providing satisfactory vision, whereas, in comparison, passengers in a flying wing have only a limited outlook through floor and windows in the entering edge.

TABLE 1

Drag Coefficients related to Frontal Area for Airfoils of varying thickness Ratio

Symmetric Youkowski airfoils. N.A.C.A. Report. Reynold's No. approx. 10^{6}—

Thickness ratio	5·51 per cent.	10·4 per cent.	15·06 per cent.	20·69 per cent.	27·26 per cent.	32·70 per cent.
Drag coefficient	0·000290	0 000210	0·000168	0·000147	0·000141	0·000164

Clark Y Airfoils. Air Corps Report. Reynolds No., approx. $10^{5\cdot5}$.

Thickness ratio	12·9 per cent.	15 per cent.	18 per cent.	21 per cent.
Drag coefficient	0·000241	0·00021	0·000208	0·00020

Double cambered M sections. N.A.C.A. Rep. No. 221. Reynolds No. approx. $10^{6\cdot5}$

Thickness ratio	6·15 per cent.	8·21 per cent.	12·01 per cent.
Drag coefficient	0·000295	0·000228	0·000170

Frontal area coefficients converted from wing area drag coefficients. The advantage of low thickness ratio for minimum drag is clear.

The main consideration in the development of the Burnelli design was the proper co-ordination of the airfoil fuselage with the wing panels in regard to lift and drag ratio and centre of pressure run. To place properly the body and to locate the tail areas with respect to downwash, and to provide ground clearance for high angles of attack with a very short landing gear. The present Burnelli design resulted after a systematic wind tunnel investigation pertaining to the aerodynamic co-operation of wing body and tail group. The full-scale stalling speed tests indicate that at high angle of attack the body has as much lift as the section of wing it replaces, the lift coefficient being 0·002. Further wind tunnel tests gave information on the effect of the body shape in plan and side view as to maximum lift. The wings are adjusted to the body at a positive angle of incidence, so that at high speed the body flies at the angle of minimum drag and zero lift, while the angle of attack of the wing panels then is higher than that of ordinary planes and closer to the angle of best lift over drag ratio. At low speed the full lift of the body is effective, and the body functions as additional wing area, permitting corresponding reduction of the area of the wing panels.

After establishing the co-operation of wing and body, effort was directed towards reduction of resistance of the appendages, *i.e.*, fuselage, pilot's cockpit, engine housings, cooling means and tail suspension. The structural and aerodynamic conditions of the Burnelli fuselage are singular. In its development, it is necessary to consider it aerodynamically as a fuselage of high width to height ratio, as well as a wing of low aspect ratio. Table 1 interprets wing drag coefficients into frontal area values. The frontal area values of the airfoils most suitable for the purpose indicate 0·00016, approximately as the minimum drag that can be achieved with an airfoil section body. Further, in accordance with tests on dirigible hulls and strut sections, a relatively short body (fineness ratio 4) gives the least resistance due to skin friction. In later development the airfoil section body was shortened to a fineness ratio of approximately five, the limiting factor being the necessary distance between front wheels and tail wheel which at present corresponds to short-coupled amphibians. The tail group is carried rearward and upward by fin extensions.

TABLE 2

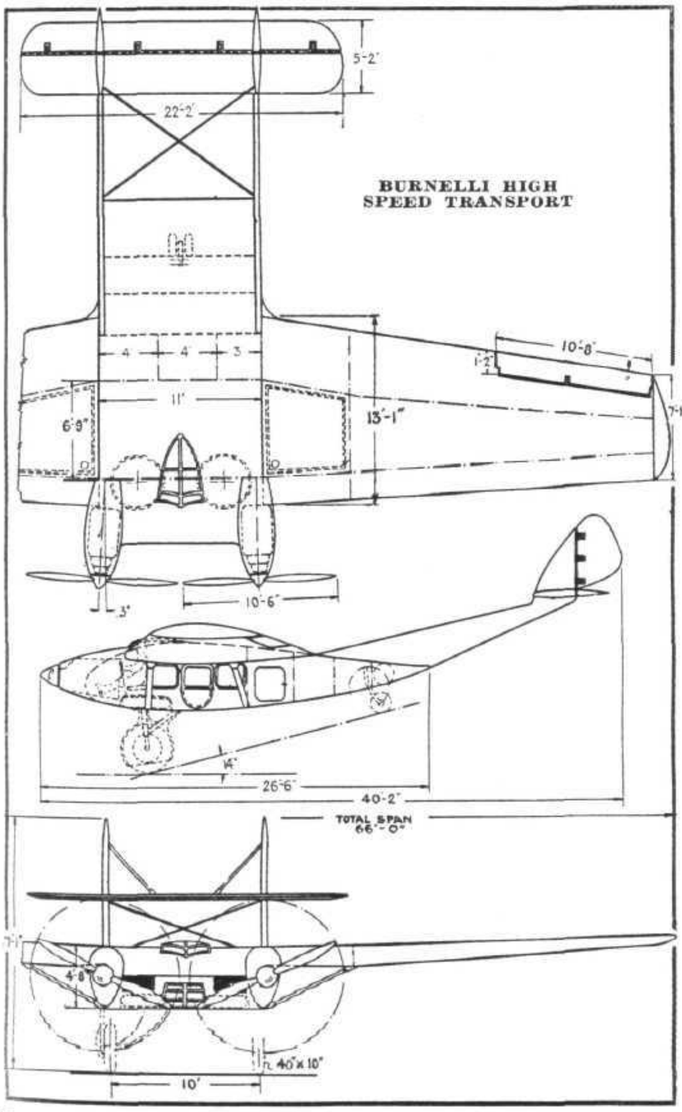
Drag of Radial engine Installation

Installation	Drag with Smooth Nose at 100 m.p.h.	Addition with Cowled Engine.	Total Drag with Cowled Engine
	Lbs.	Lbs.	Lbs.
Cabin fuselage, 21 sq. ft. Master Section (N.A.C.A. Rep. 313) ..	40	35	75
Open cockpit fuselage (N.A.C.A. Report No. 314)	42	31	73
Nacelle alone 9 ft. long (N.A.C.A. Report 314), approx.	21	22	43
Nacelle in line with wing (N.A.C.A. Techn. Note No. 320)	—	20	—
Burnelli airfoil section fuselage with two radial engines (N.Y.U. wind tunnel) Test 541A ..	per engine	18	—

All tests are related to a cowl diameter of 46 in. In comparing the drag of the nacelle alone with the drag of the nacelle in line with the wing, it must be borne in mind that for the nacelle alone 22 lb. means the drag in excess over that of the streamline nacelle body, in the nose of which the engine is mounted, and that actually 43 lb. must be sacrificed for the drag of one engine, while for the nacelle in line with the wing only, 20 and with the Burnelli 18 lb. must be added.

Extensive experiments were conducted to determine the resistance of the engine housings and cooling system. The primary consideration was to keep the shape of the body and its aerodynamic characteristic as close to that of a wing section as possible. Both water cooling and air cooling systems were tested in different arrangement and outlet directions. N.A.C.A. cowls, adapted to the twin-engine installation, increased the drag very little, the drag increase obtained being only 20 per cent. over that of the fuselage with smooth nose. This is considerably less than with wing motor installations, as shown in Table 2, and indicates the high degree of efficiency obtainable with radial engines. The problem of radial engine installation in relation to wing sections is intricate, as it is not alone a consideration of drag but also of lift, propeller efficiency, cooling and structural condition. Early tests of the N.A.C.A. cowl (Report 313 and 314) gave information on how to obtain minimum drag with sufficient cooling, the main object being to establish drag reductions compared with the uncowled radial engine. In fact, the results achieved indicate that the entire drag of an N.A.C.A. cowled radial power plant is comparable with that of the equivalent water-cooled system of other than the most advanced developments such as venturi, Prestone and skin cooling. It is not alone the drag of the engine that affects the airplane total drag, but also interference effect with relation to wings. According to wind tunnel tests, the Burnelli design is not subject to this drag increase. Recent tests

have shown the advantageous effect of merging the nacelle in wing section for minimum drag. A cowled engine alone had 43 lb. of drag, while the same nacelle merged in line with the wing gave only 20 lb. additional at high-speed, and 30 lb. at low-speed incidence. Further experiments concerning the influence of nacelle location in reference to the wing and effect on maximum lift and propulsive efficiency was carried out here and abroad. Previously, only scattered data were available concerning wing and propeller interference, tests having yielded varying results. Very little could be determined from empirical data as to lift influence with power on or idling propeller. In general, the opinion was accepted, however, that the farther the propeller was from the wing, the better. In contrast, more recent experiments disclose that to have a propeller operating in proximity to a thick airfoil section, the hub in line with the wing and moderately forward of the leading edge is superior in all-round efficiency. This solution to structural arrangement pertaining to housing the engines in a wing section to eliminate drag opens the path for airplane advancement in following the trend of all-wing design.



Ten passengers and 1,000 lb. of mail or express. Two 625 h.p. Curtiss Conqueror engines, 7 to 5 gear ratio. Retractable landing gear and tail wheel. Estimated Performance: High speed 207 m.p.h.; stalling speed 66 m.p.h.; climb 1,370 ft. per min. Gross wt., 12,400 lb.

While substantial progress has been made pertaining to air-cooling drag reduction, it has been paralleled in the refinement of water-cooling drag; partly through venturi cowls for the radiators and outlet flow; and through the use of skin-cooling which eliminates cooling resistance almost entirely; but mainly through introduction of Prestone high-temperature cooling, which reduces the radiator area to one-third. Practice has proved fuel consumption and durability satisfactory, and that considerable weight reduction is possible. Its application to high-speed commercial designs undoubtedly will assist materially in their development. The wide body of the Burnelli plane permits of the installation of radiators with venturi cowl with outlet flow parallel to the under surface. This arrangement does not add to the frontal area, and, according to recent model tests, only slightly increases the resistance of the ideally shaped airfoil fuselage.

A series of wind tunnel tests was run on a model of the UB 20-passenger plane with two 750-h.p. Packard engines. The free air radiator required for water cooling 1,500 h.p. would absorb at 160 m.p.h. over 250 h.p.; while the venturi cowl type in the entering edge with outlet at the bottom consumes with equal cooling less than 50 h.p. Further attention has been paid to a combination skin- and fin-type radiator covering the body entering edge, an adaptation of the Lamblin method, following also along the Supermarine racer cooling investigation which disclosed surprisingly high cooling effect at the entering edge of wings because of the high velocity impact of the air.

Landing gear and *empennage* represent major items of parasite resistance to be overcome before the true all-wing design can be realised. The *empennage* averages about 10 per cent. of the total drag and may be assumed to be an unavoidable resistance increment. While certain tailless airplanes have been developed, the new control arrangement has been attendant with lower wing efficiency. Landing-gear and tail-wheel-drag elimination by retraction permits the most extensive improvement in parasite resistance that can be achieved by mechanical means. It accounts for about 20 per cent. of the total drag of high-speed planes. The wide fuselage design is excellent, in that it provides space and structural suitability for wheel retraction with a simple mechanism accessible from the pilots' cockpit. The performance increase through landing-gear retraction is considerable, as indicated in Fig. 1, which also illustrates the resistance of engine cowling and cooling system. Reduction of power-plant and landing-gear resistance represents the principal advancement in airplane design in recent years.

The tabulated performance figures are high; they give the performance of a Burnelli high-speed plane which was developed from the research covered in this *résumé*. The underlying resistance coefficients correspond to advanced streamline design, in accordance with those which can be obtained from analysis of the actual performance of contemporary single-engined commercial designs. The present fast commercial planes are equipped with tapered cantilever wings with Clark Y airfoil, a radial engine of 400 to 500 h.p. with N.A.C.A. cowl and a round fuselage, the master section of which is very little in excess of the frontal area of the engine. A low-wing monoplane of this type with an orthodox landing gear achieves a high speed of 175 m.p.h., whereas the corresponding high-wing plane, which has even more frontal area, achieves 180 m.p.h. This difference is caused by the interference of the fuselage with the sensitive airflow on the upper surface of the wing of the low-wing type, which affects the induced drag at low speeds and the form drag at high speeds. Table 3 pertains to the relative merit of wing location based on tests at Goettingen and N.P.L. Through further refinement, particularly of the landing gear, it was possible to increase the high speed of the high-wing for racing purposes to 198 m.p.h. while application of landing-gear retraction and other refinements increased the speed of the low-wing monoplane to 206 m.p.h. The high-wing without landing gear could achieve 215 m.p.h. The high-wing type, which in this connection is superior aerodynamically, is not comparable to the low-wing in its structural adaptability for retraction of the landing gear.

The analysis of the performance of these designs yields a drag coefficient of 0.000024 for the wing airfoil resistance, 0.00030 for the fuselage with cowled radial engine, and for the low-wing, 0.00012 additional to the resistance of the fuselage for wing interference.

TABLE 3

Effect of Fuselage and Wing Interference

	k_y max.	k_x min.	Ratio
Wind Tunnel Tests in Goettingen. Ergebnisse I.			
Wing alone	0·00304	0·0000348	87
High wing parasol	0·00314	0·0000486	65
High wing	0·00311	0·0000417	74
Midwing	0·00302	0·0000417	72
Low wing	0·00300	0·0000443	68
Wing below fuselage	0·00302	0·0000537	56
N.P.L. Wind Tunnel Tests. Royal Aeron. Soc. Journal, 1930			
High wing with fillets ..	0·00264	0·0000700	37·7
High wing	0·00261	0·0000750	35·2
Midwing..	0·00199	0·0000630	31·5
Low wing	0·00228	0·0000855	27

The ratio of $k_y$max, over $k_x$min. figure of merit for high speed indicates in both tests the better qualities of the high-wing type. In other tests the low-wing plane occasionally shows better lift characteristics than in these, and simultaneously increase drag. Usually the interference of the fuselage of the low-wing plane with the sensitive airflow on the upper surface of the wing results in increased form drag at low incidence and increased induced drag at high angles.

TABLE 4

Power Economics of Burnelli and High-Speed Single-Engine Design

Both planes carry equal power load; use the same wing section; have the same landing speed; equal propeller tip speed and are equipped with retractable landing gear and tail wheel

Fuselage Resistance and Space Comparison

	Round Streamline Single Engine	Wing Section Burnelli Twin
Horsepower..	425	1,200
Frontal area of fuselage, sq. ft.	17·5	50
H.P. per square foot of frontal area	24·2	24
Cargo space, cubic feet	135	550
H.P. per cubic foot of cargo space	3·14	2·12
Drag coefficient of body ideally faired .. K_x	0·00016	0·00022
Engine and cooling system .. .. K_x	0·00030	0·00030
Lift coefficient of body .. .. .. K_y	—	0·0020
Equivalent wing area saving, sq. ft.	—	140
Equivalent resistance saving, flat plate.. ..	—	1·22
Resulting comparative body resistance equivalent flat plate per 100-h.p.	0·385	0·290
Percentage of engine power required by body at 190 m.p.h.	28 per cent.	21 per cent.
Engine power required at 190 m.p.h. per 100 cub. ft. of cargo space	88	46

The frontal area per h.p. is about equal, also the resistance coefficients with power plant installed; therefore, the resistance per h.p. The lift of the Burnelli wing section body as verified is allowed for by substracting the drag of the equivalent wing area replaced by the same. This results in 25 per cent. drag per h.p., and in the much lower power of 46 h.p. to fly 100 cub. ft. of cargo space at 190 m.p.h.

A comparison of the power-area relations of a high-speed single-engined design with a Burnelli high-speed design is significant (Table 4). It is based on both planes having equal power load, landing speed, similar wing section and propeller tip speed, with retractable landing gear and tail wheel. The Burnelli plane is provided with 40 per cent. more tail area to support, the outriggers extending from the short-wing section fuselage. They add 0.6 sq. ft. flat plate resistance, or 0.05 per 100 h.p., which is neglected in the comparison to balance for the wing-fuselage interference of the low-wing plane, which is 0.6 sq. ft. flat plate, or 0.14 sq. ft. per 100 h.p.-engine power. This reduces the entire comparison to a consideration of the round streamline body and the airfoil section body with maximum fairing. The comparison is carried out in Table 5, which particularly illustrates the capacity of the Burnelli plane. The comparison of the percentage of power required by the fuselage at 190 m.p.h., 28 per cent. by the single-engined plane, and 21 per cent. by the Burnelli, indicates the greater speed possibilities of the latter. The following figures, which are based on established values, complete the comparison, and give the relative high speed of both types:—

	Round Streamline Single Engine	Wing Fuselage, Burnelli
Flat plate resistance per horse-power of—		
Wing	0·00565	0·00565
Body	0·00385	0·00290
Tail areas	0·00088	0·00088
Outriggers	—	0·00050
Fuselage-wing interference ..	0·00140	—
Total	0·01178	0·00993
High speed	204 m.p.h.	216 m.p.h.

Investigation of the figures employed in this article leads to the result that the all-wing trend of design affords immediate opportunity for transport design advancement by combining the speed efficiency of the finest single-engined design with the increased safety and capacity of the multi-engined type with other desirable safety and structural advantages.

HORSEPOWER AT SPEED OF SOUND.

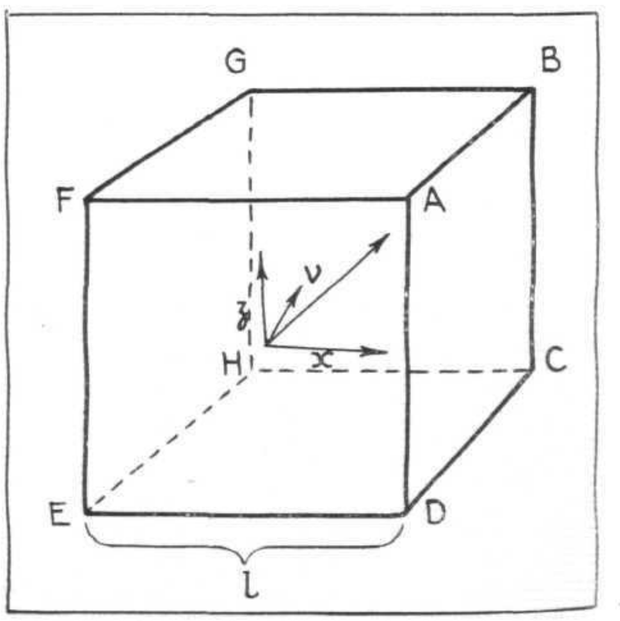
BY A. E. PARKER, B.Sc.

The Kinetic Theory of Gases states the following, and these assumptions will be made in this elementary theory:—

(1) A gas consists of molecules which are moving about in all directions and colliding with each other, and, with the walls of the containing vessel, all molecules have same mass.

(2) The molecules are considered to be perfectly elastic, that is, if they strike a body with a certain speed they rebound with the same speed.

(3) The molecules are considered to be infinitely small. This assumption does not make any difference at ordinary pressures.



(4) There is no intermolecular attraction. (This is not an hypothesis of the kinetic theory of gases, but is assumed in this elementary theory.)

(5) The average value of the speed of the molecules is constant at constant temperature, the action of heat being to increase the velocity of the molecules. (Speed of translation.)

(6) There is no energy lost in rotation of the molecules.

Consider the cube side l, containing N molecules of gas at ordinary pressure.

Resolve the velocities parallel to ED, DC and AD. Then we can say that on the average one-third of the molecules will be travelling parallel to each direction, and work on this assumption; but we will not make this assumption.

Suppose a molecule whose velocity perpendicular to the face AC is x, rebound from it, then the change in momentum $= 2mx$.

After the rebound the molecule will move towards the opposite face FH, and after a time $\frac{2l}{x}$, it will collide with the face AC again. Therefore in one second it will make $\frac{x}{2l}$ impacts with the face AC. This is the same, of course, for the face FH.

If there are N molecules in the cube, then the change in momentum is:—

$$2\,mx \times \frac{x}{2l} \times \mathrm{N} = \mathrm{N}m\,\frac{x^2}{l} \text{ per sec.}$$

the same force will be exerted on the face FH. Similar reasoning gives results for the y and z directions. Hence

$$2\,\mathrm{N}m\,\frac{x^2}{l} + 2\,\mathrm{N}m\,\frac{y^2}{l} + 2\,\mathrm{N}m\,\frac{z^2}{l} = l\,6l^2\,p.$$

where p is the pressure. The above follows since force = change in momentum per sec.

$$\therefore\ \frac{2\,\mathrm{N}m}{6\,l^3}\left\{x^2 + y^2 + z^2\right\} = p.$$

$$\therefore\ \tfrac{1}{3}\,\frac{\mathrm{N}m}{l^3}\left(\overline{\mathrm{V}}^2\right) = p\,;\ \overline{\mathrm{V}}^2 = x^2 + y^2 + z^2.$$

also since m is the mass of a molecule, N the number. $\mathrm{N}m$ is the mass of the volume l^3 of gas. Hence $\frac{\mathrm{N}m}{l^3} = \rho$ the density.

$$\therefore\ \tfrac{1}{3}\,\rho\,\overline{\mathrm{V}}^2 = p.$$

$$\text{or } \overline{\mathrm{V}} = \sqrt{\frac{3\,p}{\rho}}$$

now $p = 14.7 \times g$ lbs. per sq. in.

$\rho = 0.0764$ lb. per cu. ft.

$$\therefore\ \overline{\mathrm{V}} = \sqrt{\frac{3 \times 14{\cdot}7 \times 144 \times 32{\cdot}3}{0{\cdot}0764}} = 1665 \text{ ft. per sec.}$$

The velocity of sound is 1,120 ft. per sec.

$$\therefore\ \frac{\text{velocity of molecules}}{\text{velocity of sound}} = 1{\cdot}486 \text{ approx.}$$

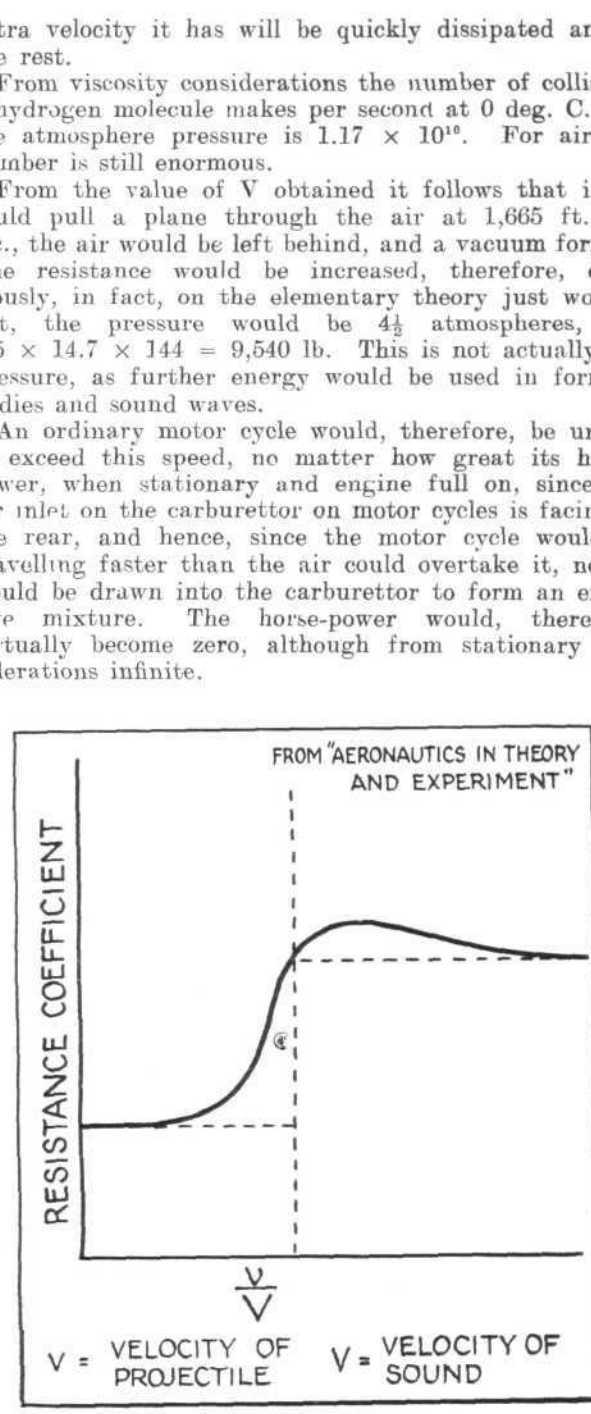
This is due to the fact that the molecules are not infinitely small, and therefore it takes time for the momentum to be passed on when two molecules collide, hence the velocity of sound is less than the velocity of the individual molecules.

It must be remembered that the velocity V is the root mean square velocity of the molecules, and this is not necessarily equal to the average value of the velocities of the individual molecules. The two averages are only the same if all the velocities of the molecules are the same, or nearly so. In a gas there are so many collisions, that if one molecule, say, is travelling faster than the rest, it will collide with molecules, and the extra velocity it has will be quickly dissipated among the rest.

From viscosity considerations the number of collisions a hydrogen molecule makes per second at 0 deg. C. and the atmosphere pressure is 1.17×10^{10}. For air the number is still enormous.

From the value of V obtained it follows that if we could pull a plane through the air at 1,665 ft. per sec., the air would be left behind, and a vacuum formed. The resistance would be increased, therefore, enormously, in fact, on the elementary theory just worked out, the pressure would be $4\frac{1}{2}$ atmospheres, *i.e.* $4.5 \times 14.7 \times 144 = 9{,}540$ lb. This is not actually the pressure, as further energy would be used in forming eddies and sound waves.

An ordinary motor cycle would, therefore, be unable to exceed this speed, no matter how great its horsepower, when stationary and engine full on, since the air inlet on the carburettor on motor cycles is facing to the rear, and hence, since the motor cycle would be travelling faster than the air could overtake it, no air would be drawn into the carburettor to form an explosive mixture. The horse-power would, therefore, virtually become zero, although from stationary considerations infinite.



This would be true for an aeroplane, if the carburettor was the same; but, further, a vacuum tends to form behind the airscrew, and therefore it cannot get any purchase on the air. The problem is not, however, so simple as this, as an airscrew consists of a variable aerofoil moving along a helicoidal path, and the air does not impinge perpendicularly. However, the efficiency of the aerofoil elements would be very poor at these velocities, and terrible eddies and vortices would be formed in their trail. Sound waves would also be produced. The resistance of most well-shaped bodies varies as the square of the speed. The graph shows the variation in the resistance coefficient of a projectile with increase of $\frac{\mathrm{V}}{v}$. The resistance coefficient is constant up to 500 ft. per sce., therefore the resistance is accurately proportional to the square of the speed. Beyond this velocity, the resistance coefficient rapidly increases up to a point greater than the velocity of sound. It then settles down to a constant value after having decreased.

The maximum value of the resistance coefficient corresponds to the velocity of the molecules, but there are other factors coming in. At these velocities, the air would be compressed, the pressure and density therefore

increased, and modifications would therefore have to be introduced. The graph will be found in "Aeronautics in Theory and Experiment," by W. L. Cowley, A.R.C.Sc., D.I.C., and H. Levy, M.A., B.Sc., F.R.S.E.

It must be remembered that the mathematical theory of fluid motion does not take into consideration molecular velocities; hence the phenomena occurring when the velocity of sound is reached cannot be explained by it.

N.B.—From the formula $R = 0.0032\ S\ V^2$, where R is the resistance in lb. wt., S the area in sq. ft., and V the speed in m.p.h., the resistance on a sq. ft. should be $= 0.0032 \times (1{,}135)^2 = 4{,}130$ lb. at speed of molecules. Now from the curve connecting V/v and the resistance coefficient, we see that the upper limit of the resistance coefficient is approximately 2.25 times the lower limit. But 9,540 : 4,130 = 2.3 approx., in good agreement with the previous value 2.25. Therefore the kinetic theory of gases explains the increase in resistance coefficient.

TORSION IN THIN CYLINDERS.

By E. H. ATKIN, B.Sc. (LOND).*

A considerable volume of work has been done in the investigation of the stresses and strains in elastic cylindrical prisms under pure torsion. The theoretical work of Saint-Venant[1] and others has been supplemented experimentally by the work of Prandtl, whose membrane analogy was developed by Griffith & Taylor[2]. Hence it is now possible, theoretically or experimentally, to determine the stresses in any torsionally loaded prism of any section whatever.

For most engineering purposes, however, the experimental method is out of the question as the technique is too involved and the apparatus too expensive. Unless, therefore, the cross-section is one of the simple geometrical forms which can be dealt with by a mathematical formula, or one which can be dealt with by the semi-empirical rules due to Griffith and Taylor[3], the designer is compelled to rely on his experience.

The only other method available, a step by step method of integration due to Thom[4], is too difficult to be of general use.

Among the sections which cannot be dealt with by either of the two practicable methods must be included a series of sections of a type common to modern all-metal aircraft construction. This is the drawn strip steel closed section. Hence some simple method of determining the shear stresses in a thin-walled hollow cylinder under torsion has become very desirable. But, while the solution of this problem in its simplest form is fairly well known, the general solution does not appear to have been put down in a form suitable for routine calculation.

Indeed, as far as the writer is aware, the problem has not been worked out in detail at all.

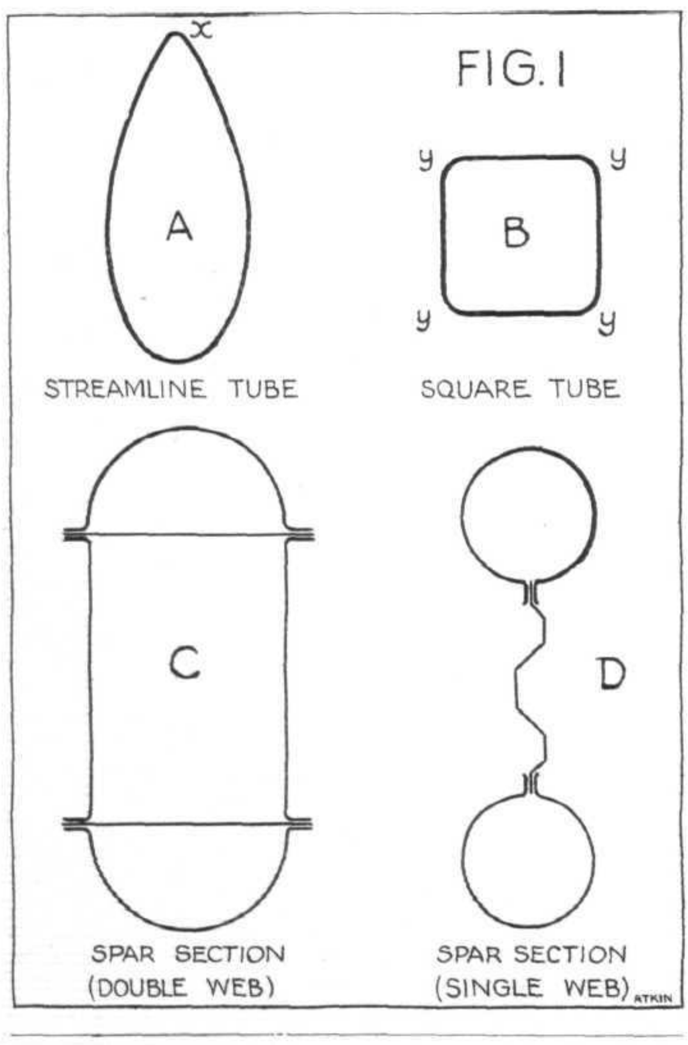
It is, therefore, proposed to give, in this article a method of determining the shear stresses in any thin walled section under pure torsion.

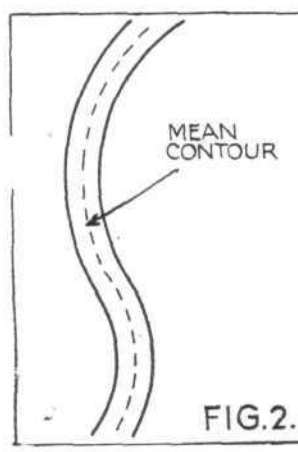
Four such sections are shown in Fig. 1. The method of calculation for the stream line tube A, and the square tube B is, as already stated, well known.

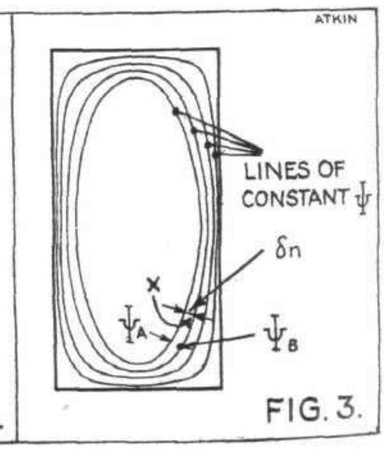
Let fs be the mean shear stress at any point round the section and t the thickness at that point, Am the area enclosed by the mean contour (*see* Fig. 2) of the section, and T the applied torque. It can be shown[5] that

$$f_s = \frac{T}{2t\,Am} \qquad \text{.................................} \quad (1)$$

This formula holds round any thin section such as A or B in Fig. 1, even though the thickness varies round the cross-section, provided that the curvature of the cross-section is small at the point considered. But, at a point of large curvature, the maximum shear stress on the concave side is much higher than the mean. Points such as x in section A, and y in section B therefore, require special consideration. The calculation of the stress at these points will be discussed later.







Formula (1) can be obtained in a simple manner by an independent investigation; but as such a proof can be found elsewhere, we shall confine ourselves to deducing it as a particular case of a more general theory.

It will perhaps be as well, however, to give the companion formula for the angle of twist θ of a length l of the section.

The work done on the section $= \frac{1}{2}\,T\theta$

And the strain energy of the section is given by the integral

$$\frac{l}{2G}\int f^2_s\, tds$$

taken right round the mean contour of the section.

G is the modulus of rigidity, and ds an element of the mean contour (*see* Fig. 2).

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By equation (1) this integral may be written

$$\frac{l}{2G}\int\frac{T^2}{4t^2A_m^2}\cdot tds = \frac{lT^2}{8GA_m^2}\int\frac{ds}{t} = \tfrac{1}{2}T\theta$$

therefore

$$\theta = \frac{lT}{4GA_m^2}\int\frac{ds}{t} \quad\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (2)$$

If t is constant and S is the mean perimeter, (2) becomes

$$\theta = \frac{lTS}{4GtA^2_m} \quad\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (2\text{A})$$

We now pass to the more general case in which such sections as C and D in Fig. 1 have to be considered.

The discussion of the general case will be divided into three parts: (i) The general equations of the torsion problem; (ii) Cylinders with multiply connected cross sections; (iii) The stresses in multiply connected cross sections.

(i) General Equations.

The equations for any cylindrical prism under torsion are well known, but are given here for the sake of completeness.

If coordinate axes are taken so that the Z axis is parallel to the generators of the cylinder, then the displacement (u, v, w) of any point in the prism from its unstrained position is given by

$$u = -\theta yz,\quad v = \theta zx,\ w = \theta\phi(xy)$$

Where θ is the angle of twist per unit of length of the cylinder.

by the shortest distance between the two contours gives the resultant shear strain per unit angle of twist at that point. It follows therefore that the resultant shear stress f_s at any point X in Fig. 3 is given by,

$$f_s = G\theta\,\frac{\Psi_A - \Psi_B}{\delta n} \quad\ldots\ldots\ldots\ldots\ldots\ldots\ (3)$$

Where Ψ_A is the value of Ψ on contour A and Ψ_B is the value of Ψ on contour B, δn being the length of the normal to the curve A (or B) at the point X intercepted between the curves A and B.

Another important property of Ψ, to be inferred from (3), is that it is constant round any boundary of the section. From this it follows that if Ψ_A and Ψ_B are the values of Ψ on the inside and outside boundaries of a thin-walled hollow section, then the shear stress at any point is given by equation (3) above.

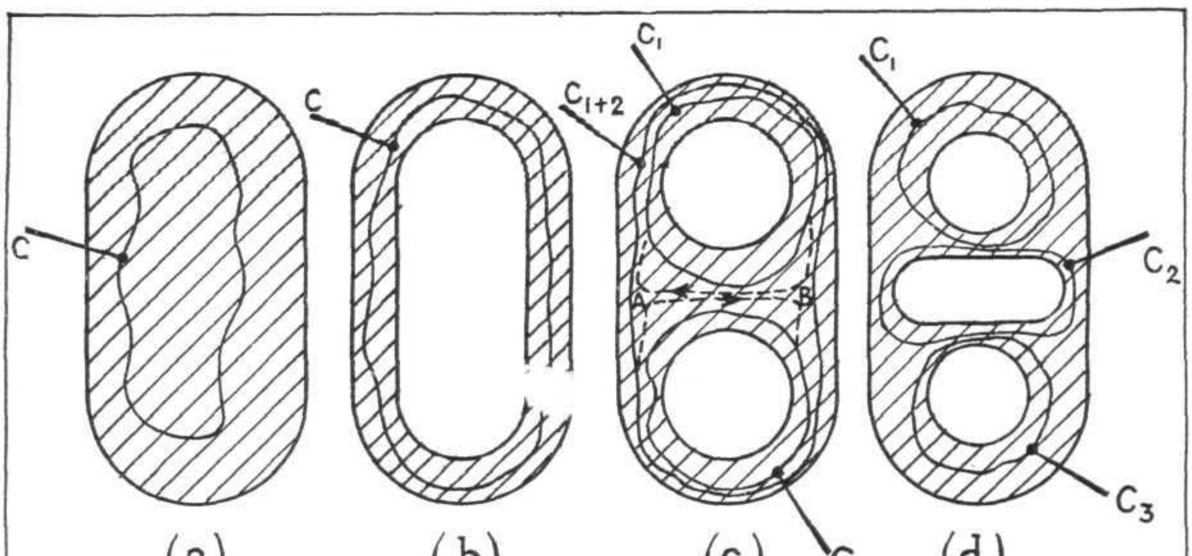
It should further be noted also that Ψ satisfies the differential equation

$$\frac{\partial^2\Psi}{\partial x^2} + \frac{\partial^2\Psi}{\partial y^2} + 2 = 0$$

and that the components of shear stress parallel to the x and y axes are $G\theta\,\frac{\partial\Psi}{\partial y}$, and $-G\theta\,\frac{\partial\Psi}{\delta x}$ respectively. This is important in the calculation of the torque.

(ii) Cylinders with multiply-connected Cross Sections.

The cross-sections of cylinders may be classified, for the present purpose, according to a scheme borrowed from hydromechanical theory.



(a) (b) (c) (d)

FIG. 4.

The torsion problem is to find the function ϕ which satisfies all necessary conditions.

It is known that ϕ must satisfy the equation

$$\frac{\partial^2\phi}{\partial x^2} + \frac{\partial^2\phi}{\partial y^2} = 0$$

This being so, it follows that there is a conjugate function ψ such that

$$\frac{\partial\phi}{\partial x} = \frac{\partial\psi}{\partial y},\ \text{and}\ \frac{\partial\phi}{\partial y} = -\frac{\partial\psi}{\partial x}$$

which satisfies the same equation.

Furthermore, with the function ψ there is associated a function Ψ such that

$$\Psi = \psi - \tfrac{1}{2}(x^2 + y^2)$$

For our present purpose the most important property of Ψ is that if lines of constant Ψ be plotted on the cross-section of the prism (as contours are on a map) as, for instance, for the rectangle in Fig. 3, then the difference between the values of Ψ for two consecutive contours near a given point, divided

Consider Fig. 4. A section such as (*a*) is termed singly connected; one such as (*b*) doubly connected; one such as (*c*) triply connected; one such as (*d*) quadruply connected and so on. It is observed that the number of connection, is equal to the number of boundaries, and therefore to the number of values that Ψ may assume at the boundaries of the section.

The explanation of this mode of classification by reference to "degrees of connectedness," is as follows:—

In (*a*) any closed circuit *c* can be contracted to a point without passing outside the material of the cross section; in (*b*) one circuit can be drawn which *cannot* be contracted to a point without passing out of the material of the cross-section; in (*c*) two such circuits, which are *irreconcilable*, can be drawn; and in general, in an n-triply connected cross-section $(n-1)$, such circuits can be drawn. Circuits are irreconcilable when they cannot be made to coincide with one another without being displaced out of the material of the cross section. For instance, in (*c*), Fig. 4, the two

circuits c_1 and c_2 can be made to agree with circuit c_{1+2}, the parts AB being equal and opposite, and therefore cancelling out. Therefore, although three irreducible circuits can be drawn in section (c), only two are irreconcilable. Hence the section is triply connected, not quadruply connected.

More could be written about this scheme of classification, but sufficient has been stated to explain the terminology used.

We can now pass on to the stresses in these sections.

REFERENCES.

(1) *Theory of Elasticity*, Love.
(2) R. & M. No. 333, June, 1917, and R. & M. No. 392, Jan., 1918, G. I. Taylor, M.A., and A. A. Griffith, M.Eng.
(3) R. & M. No. 334. June, 1917, A. A. Griffith, M.Eng.
(4) R. & M. No. 1194, A. Thom, D.Sc., Ph.D., A.R.T.C.
(5) See articles by Batho in *Engineering*, Oct., 15, 1915, and Nov. 24, 1916.

(*To be concluded.*)

TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any Bookseller.

REPORT ON THE OXIDATION CHARACTERISTICS OF FUEL VAPOURS WITH REGARD TO ENGINE DETONATION. By E. Mardles, B.Sc., F.I.C. With an Appendix by Professor A. Egerton, F.R.S. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1374. (E. 46). 27 pages and 14 diagrams. November, 1930. Price 1s. 6d. net.

The problem of what precisely happens when fuel molecules are acted upon by the oxygen of the air what precisely is the chain of reactions leading to the ultimate products of combustion, has aroused considerable interest because of its special bearing on engine practice.

At the suggestion of Professor Callendar, F.R.S. (1926), an intensive study of the oxidation characteristics of fuel vapour in air was undertaken with a view to throwing light on the phenomenon of detonation in an engine. At the end of 1926 sufficient results had been obtained to indicate the catalytic nature of combustion and the significance of explosive peroxides; a report was then issued, R. & M. 1062.

Since that time a large number of investigations have been carried out on gaseous reactions by different workers and different views have been expressed with regard to the main features. The paper includes a critical survey of the new information and a summary of recent experiments carried out in the Air Ministry Laboratory.

The peroxide theory of combustion and detonation (Callendar and others, 1926) has been confirmed and strengthened by recent discoveries and the action of anti-knocks and inhibitors can be traced to the removal or decrease in concentration of the active catalyst in the gaseous mixture undergoing combustion, since it appears that the rate of reaction is a function of this concentration. The temperature coefficient of gaseous reaction is high for hydrogen, ether, normal heptane, normal hexane and other hydrocarbons liable to cause detonation in an engine and is relatively low for carbon disulphide, methane, ethylene, coal gas, amylene, benzene and other anti-knock fuels. Inhibitors were found invariably to lower the temperature coefficient and accelerators to raise it. These findings are in accord with the conclusions of Tizard and Pye (1922) that the detonation tendency of fuels is dependent on the temperature coefficient of gaseous reaction.

The seat of action of organometallic inhibitors is in the metal portion, the metal surface behaving both as a catalyst in lowering temperature of reaction, and as an inhibitor in controlling the concentration of peroxides in the body of the gas so reducing the temperature coefficient of combustion.

A short critical review of various recent hypotheses cogent to the subject of combustion has been made.

MATHEMATICAL INVESTIGATION OF STRENGTH OF WOODEN SEAPLANE HULLS OF THE LINTON-HOPE TYPE OF CONSTRUCTION. (FULL-SIZED MACHINES—THIRD SERIES). By W. C. S. Wigley, M.A., of the William Froude Laboratory, Teddington. R. & M. No. 1376 (Ae. 501). (18 pages and 4 diagrams.) March, 1924. Price 1s. net.

This paper consists of an investigation made at the request of the Seaplane Panel of the Aeronautical Research Committee into the strength of wooden seaplane hulls of the Linton-Hope type (P. 5).

The chief difficulties in the application of elastic theory to structures of this type are:—(1) The obtaining of a workable solution of the general elastic equations which will apply to a hull which is not shaped to simple mathematical curves. This solution must also take fair account of the distributions of applied forces which may be experienced in practice. (2) To find the alteration in the stresses and strains caused by the non-isotropic character of the materials employed.

The first difficulty has been attacked by separating the stress-strain system caused by longitudinal bending moments and shear forces from that caused by the transverse hoop compression stresses due directly to the local pressures on the hull.

The second difficulty has been attacked with the aid of the figures found experimentally by Prof. Robertson* for the aelotropy of wood.

The longitudinal strength of the hull is calculated for two conditions: first, supported at ends; secondly, supported at the C.G.—and is found to be satisfactory. In Appendix I are given the moduli of the timber employed in the construction of the P. 5 hull as measured by Dr. A. A. Griffith at the R.A.E., and in Appendix II, as an experimental confirmation, the same methods of calculation are used to predict the crushing load of a Supermarine "Seagull" hull which has been actually crushed at the R.A.E. The crushing loads given by theory and experiment are found to agree within as narrow limits as could be expected.

The transverse strength under the hoop compression is also calculated, and it is found that a factor of safety as low as 1·3 may occur, the additional strength of the outer planing bottom and any special internal cross-bearers being neglected. These will certainly tend to increase the factor of safety, but to an unknown extent.

It is suggested that the provision of more longitudinal stringers, individually of smaller cross-section than those used at present, would improve the transverse strength.

* A report of materials of construction used in aircraft. By Lt.-Col. C. F. Jenkin, C.B.E., M.I.C.E.

TESTS ON BIPLANE FINS ON A MODEL OF THE R.101 HULL. By R. Jones, M.A., D.Sc., and A. H. Bell. R. & M. No. 1379 (Ae. 504). (13 pages and 3 diagrams.) October, 1930. Price 9d. net.

The experiments described herein were conducted in response to a request from the Royal Airship Works, Cardington, with the object of examining the feasibility of fitting airships with biplane fins constructed on the lines of aeroplane wings instead of with fins of the orthodox type. It was hoped that such fins would assist in the saving of weight in the tail structure of the airship, but it was realised that that could only be done provided that sufficient stability could be attained with fins of such a size that standard methods of construction applied to aeroplane wings could be utilised.

Biplane fins (R.A.F. 27 section) were fitted to an already existing model of the hull of R.101 and compared with fins 3 of R. & M. 1168.

The permissible area of the biplane fins is, however, so much less than that of the standard fins that the stability of the model is less than that of the original. Introducing turbulence at the nose of the model appears to decrease fin efficiency, but improves the stability characteristics of the bare hull, the net effect on the stability of the complete model being a slight increase—neglecting any possible effects on N_r and Y_r which were not examined.

The lateral force curves on the biplane fins are different in form from those on the standard fins, and observations of the direction of flow near the positions occupied by the fins indicate that fins of the new type may be more sensitive to *vl* effect than the original.

The results show that it would not be advisable to construct biplane fins of this type on full scale unless they could be made larger.

THE PRESSURE ON THE FRONT GENERATOR OF A CYLINDER. By A. Thom, D.Sc., Ph.D. Communicated by Professor J. D. Cormack. R. & M. No. 1389 (Ae. 511). (15 pages and 8 diagrams.) December, 1930. Price 9d. net.

When a cylinder is placed transversely in a current of fluid the pressure produced in the front generator is accepted as being $\frac{1}{2}\rho V^2$ above static pressure. This is known to be accurate provided the speed of the fluid is such that compressibility effects can be neglected. If, on the other hand, the speed, and so the Reynolds number, is low, viscous effects make themselves felt, the boundary layer becomes thick, and the above expression no longer holds.

The problem has been approached in three different ways: (1) by a method based on the boundary layer theory; (2) by approximate solutions of the equations of viscous flow at low Reynolds number; and (3) experimentally at low Reynolds number.

It is shown that at all speeds unaffected by compressibility a closer approximation is given by $(1 + c/R)\frac{1}{2}\rho V^2$, where c, while being dependent on Reynolds number, is about 8 at all usual speeds.

FULL-SCALE MEASUREMENT OF LIFT AND DRAG OF SOUTHAMPTON BOAT SEAPLANE. By A. S. Crouch, D.I.C., A.C.G.I. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1391 (Ae. 512). (3 pages and 3 diagrams.) April, 1931. Price 6d. net.

No full-scale data relating to the lift and drag of boat seaplanes is available. This report describes experiments made on a "Southampton" boat seaplane primarily with a view to establishing some full-scale data for this type of aircraft.

The lift and drag curves of the aircraft have been deduced for incidence between 2° and 10° from glides with the engines switched off. A few glides were also made with the engines fully throttled but not switched off.

The maximum lift coefficient of the aircraft could not be reached owing to inadequate control beyond 10° incidence. Glides with airscrews stopped are practicable, and the airscrews can be re-started by diving to a speed of approximately 110 m.p.h.

MEASUREMENTS OF ACCELERATIONS ON AIRCRAFT DURING MANŒUVRES. By E. Finn, B.Sc., and A. E. Woodward Nutt, B.A. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1392 (Ae. 513). (5 pages and 6 diagrams.) December, 1930. Price 9d. net.

Accelerometer records of general aerobatic manœuvres have been taken at Martlesham Heath on various types of aircraft. For the present report a definite series of manœuvres have been performed on as many different types of aircraft as possible, and the accelerations occurring in every case measured. A total of 340 manœuvres on 14 different types of aircraft have been analysed.

For manœuvres correctly performed by skilled pilots, the average maximum acceleration is of the order of 3_g and the average minimum of the order of 0_g. There is evidence to show that higher values would be obtained by unskilful or inexperienced pilots.

Private Flying & Club News

FIRST ALL WOMEN'S FLYING MEETING

THE Ladies' Committee of the Northamptonshire Aero Club, under the chairmanship of Mrs. Harold Brown and the secretaryship of Miss Molly Olney, was responsible for organising the first All-Women's Flying Meeting to be held in this country on Saturday, September 19. All those who have had the pleasure of meeting Miss Olney know that she is one of the hardest working members of the club, and they were not surprised, therefore, that the meeting turned out such a success as it did. There were, of course, many points of organisation which could have been bettered, and, in fact, many ways in which the meeting could have been made a far greater success than it was, but, in view of the fact that it was their first attempt at running such a show, almost without male help at all, we feel they are

LETTING HER GO: The Duchess of Bedford releases Miss Tyzack to fly off and open the meeting.

SOME OF THE WOMEN PILOTS: Miss Tyzack, Mrs. Victor Bruce, Miss Slade, Miss Spicer, Miss Page, Miss Gower.

to be congratulated in doing as well as they did. Knowing Miss Olney as we do, we can safely say that she will benefit by the few mistakes of this occasion, and that

A CLOSE SHAVE: Nursie and her charges look panic-stricken as a "bomb" falls close to them at Sywell.

future meetings will probably show a great deal of improvement.

The attendance of visiting aircraft was really amazing, particularly as there were three other meetings on the same day in other parts of the country, but, notwithstanding this, 42 aircraft arrived. Had the weather been clearer—for in parts it was very thick indeed—no doubt this number would have been even greater. As it was, several well-known women pilots did not turn up as had been hoped, but, despite this, of those women present, some 10 were pilots of their own machines.

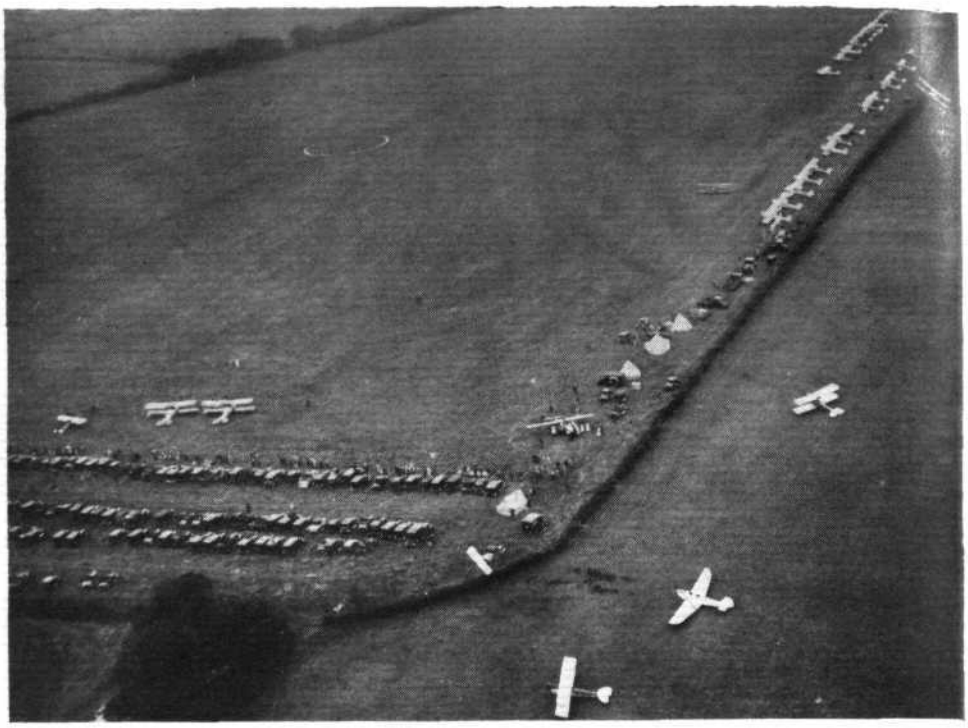
One of the chief events of the meeting was the Ladies' Race. This was two laps of a 22½-mile circuit, and was won in an extremely close finish by Miss Slade, the well-known Secretary of Airwork, Ltd., at Heston. Without wishing to damp the ardour of these ladies, we would like to suggest that they temper their enthusiasm with a little more caution on future occasions, for both the take-off and the finish provided several nerve-racking moments of the type which, for the good of everybody, should be avoided. We do not wish to infer that any of the flying was intentionally negligent, but at the same time nobody can deny that it was just a little too exuberant. We all want to popularise flying, particularly so amongst women, and the chief way to do this is to make people realise that it is safe. Let all those who were taking part in this race, therefore, realise that it is far better for them to avoid endangering the other pilots, even if it means losing the race, than it is to win at the expense of narrowly-averted disaster.

Miss Gower, unfortunately, had her engine nearly completely cut out as she arrived over the aerodrome at the finish, and her forced landing across wind was a fine exhibition of skill.

The handicapping of the race was done by Capt. Dancy and Mr. Rowarth, and the times show that, as usual, these two gentlemen produced a perfectly amazing finish.

The meeting was preceded by an arrival competition, which was won by Miss Slade in her "Moth" (Gipsy I), G-AAIW, which she flew from Heston.

After lunch, during which Miss Gower did quite a lot of joy-riding in her "Spartan" (Cirrus III), Her Grace the Duchess of Bedford opened the meeting proper. This ceremony took the form of severing a tape which was tied to the tail skid of a "Moth" at one end and to the Aerodrome at the other end. In the pilot's cockpit of this machine was Miss Tyzack, the club's first woman pilot, and after the Duchess of Bedford had released her machine, she took off. When flying overhead, she dropped a rather beautiful Victorian Posie type of bouquet, which floated down attached to a small parachute, and, on being picked up, this was presented to the Duchess by little Miss Deterding.



A FINE ATTENDANCE: Sywell from the air, showing the large number of aircraft which attended the All Women's Meeting. In the left foreground is a Comper Swift (Pobjoy) and two Redwings (Genet). Formations of three of each of these aircraft were a feature of the meeting.

Col. Shelmerdine, the Director of Civil Aviation, who together with Mrs. Shelmerdine and Kathleen Countess Drogheda had been flown up in the Imperial Airways "Wessex" (3-7 cylinder Genets) by Mr. G. P. Olley, then broadcasted a short opening speech. Next, when the Press and cinema photographers had done their best to make all the women pilots look thoroughly self-conscious, there was a fly-past of quite a number of different types of aircraft. Miss Tyzack was flying in the "Cutty Sark," Lady Bailey flew her "Puss Moth," Mrs. Victor Bruce her "Bluebird," Miss Pauline Gower her "Spartan,"

THE LADIES' RACE

Machine	Pilot	Starting Time		Finishing Time		Speed
		min.	sec.	min.	sec.	m.p.h.
Redwing (Genet II)	Miss Joan Page ..	00	00	16	10⅘	83¼
Spartan (Cirrus III)	Miss Pauline Gower	01	36	16	36	90
Moth (Gipsy I) ..	Mrs. Young	02	01	16	30	93
Bluebird (Gipsy III)	Mrs. Victor Bruce ..	02	10	16	10⅗	96½
Moth (Gipsy I) ..	Mrs. Giles	02	17	16	51	92¾
Moth (Gipsy I) ..	Miss Slade	02	17	16	10	97¼

Miss Slade a "Klemm," Miss Joan Page her "Redwing," and Miss Aitken her "Moth."

A formation flight by Miss Gower, Miss Page and Miss Spicer, all in "Redwings," was made in the direction of Northampton, to let people know that the meeting was starting.

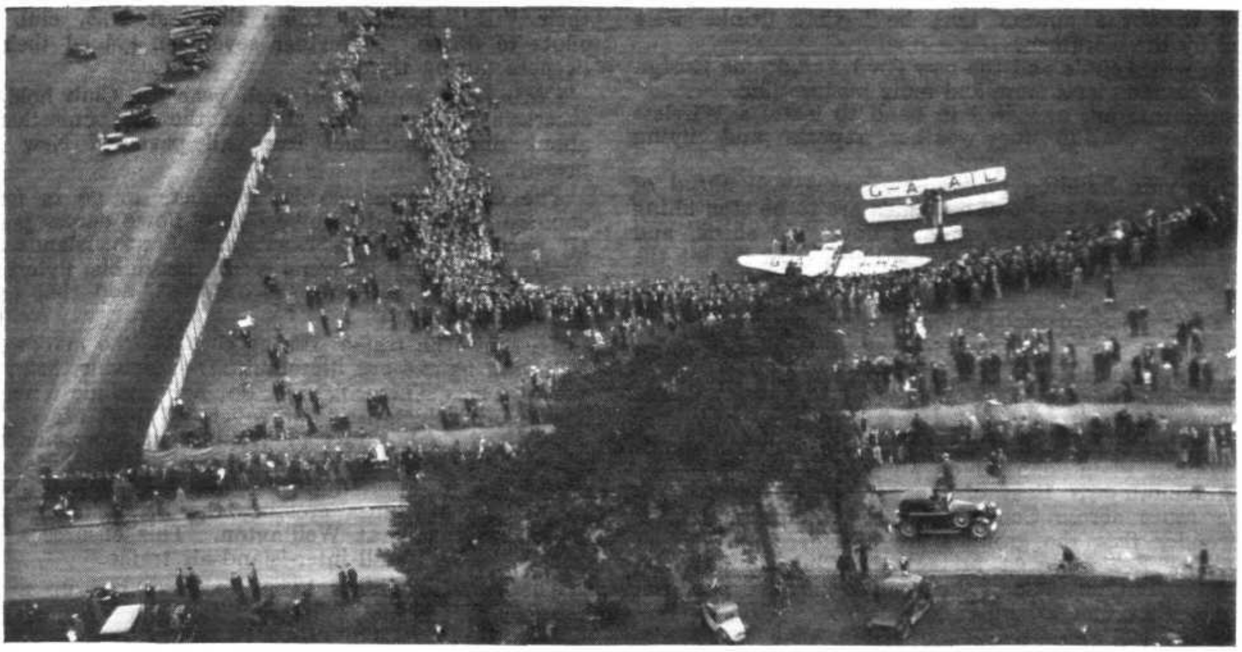
The next event was an aerobatic display by Miss Tyzack in a "Moth." Seeing that this lady has only done some 50 hours since obtaining her licence, her show was really extraordinarily neat. She first of all did several loops, and then finished with two of the prettiest and most smoothly executed stalled turns that we have seen.

As soon as she had landed, a large perambulator, some 8 ft. high, was seen careering across the aerodrome. Standing behind it, clutching the handle with an agonised expression, was a well-dressed nurse, whom disrespectful people said was really a chamber-"maid," or the Lord High Chamberlain, or something like that, though we thought she looked too oily to be either of these! Her two charges were vaguely familiar. The small one certainly seemed full of spirit and had pink shell-like ears, while the other, a fine red-faced b(r)onnie boy, might well have been the offspring of John Bunny, and no doubt will be used for testing "Moth" undercarriages instead of baby-carriages before long.

This perambulator had not gone far before two aircraft came swooping down on it, and commenced throwing flour-bag bombs on it. Two direct hits caused great consternation, and, after an extremely accurate display of bombing, the nurse and her charges directed this weird contraption to safety behind a petrol lorry. The works of this perambulator were, of course, an open secret to those who had the luck to attend these Northampton meetings, and after the last show, when the said works, a product of Henry F——, were disrupted somewhat violently, we did not think we should ever see them in working order again. The fact that they were running once more for our amusement is a tribute to the ground staff of the aerodrome.

At this point the race was flown off, and following this there was a procession of famous women in the form of tableaux. These were:—Helen of Troy, Miss Mary Bull; and attendant, Miss Audrey Garner; Queen Boadicea, Miss Joan Bull; and daughters, Misses J. Freer and B. Caswell; Joan of Arc, Miss Alison Cook; Queen Elizabeth, Mrs. Douglas Pain; Sir Walter Raleigh, Mrs. Sambidge; Nell Gwyn, Miss Elizabeth Cook; Flora Macdonald, Miss Evelyn Gillett; Prince Charlie, Miss Gent; Florence Nightingale, Miss Whitworth; Grace Darling, Miss V. Bailey; Mrs. Siddons, Mrs. Dobbyn, Mrs. Telling and Miss Worrall; Britannia, Mrs. C. Green.

Several other events which were to have taken place then had to be abandoned, as the thick weather became moist and developed into a drizzling rain, which gradually got worse, so that we all had to think of getting transport back to Northampton in order to get changed for the evening dinner and dance which was being held later in the evening. This function went off in a most enjoyable manner, in spite of the fact that the resources of Franklyn's, where it was held, were strained to the limit, as, instead of the expected 80 guests, some 200 actually arrived; however everyone made the best of things, and expressed the hope that further such meetings would be held at Northampton.



AVIATION ENTHUSIASM: A small corner of the field at Southend showing some of the huge crowd which gathered to see the flying last Sunday. The Monospar (2 Salmsons) in the foreground caused a very great deal of interest and it was with difficulty that the crowd which surged round it could be held at bay.

JOY-RIDING AT SOUTHEND.—Mr. J. Chaplin and Mr. Talbot-Lehmann have recently been holding a series of joy-riding meetings at such places as they found there was any likelihood of much interest being raised. Last Sunday, September 20, their venue was Southend. The field used was just north of the town, and the crowd who came must have been well over 10,000. Besides joy-riding they also had attractions, such as an excellent aerobatic display by Flt. Lt. Schofield on Mr. Chaplin's "Avian" (Hermes); a demonstration on the "Klemm" (Gipsy II) by Mr. Rogers; a demonstration of the "Monospar" (two Salmsons), also by Flt. Lt. Schofield; and a parachute drop by Mr. Fairlie. This latter got severely shaken on landing, due to his chute being foul on the way down, and therefore not supporting him adequately. From what happened, it looked as if sufficient care had not been taken in packing the chute, for that, or something similar, was the cause of the shroud lines becoming entangled in the canopy, and thus preventing the whole from opening correctly. We were thankful that Mr. Fairlie was not more seriously hurt. We have never advocated the use of parachute drops merely as a stunt to draw a crowd, but if they must be used, then, in fairness to the jumper himself and also to the maker of the parachute, we feel that the very greatest care should be taken to ensure that the drop shall be an entire success. We have so far avoided a disaster in this country such as occurred in Brussels last year, and have no wish for anything of a similar nature to take place. An accident of any kind at all would have the direst effects on such meetings, and must be avoided at all costs. Mr. Chaplin and his friends are to be congratulated on spreading interest in flying to such a degree.

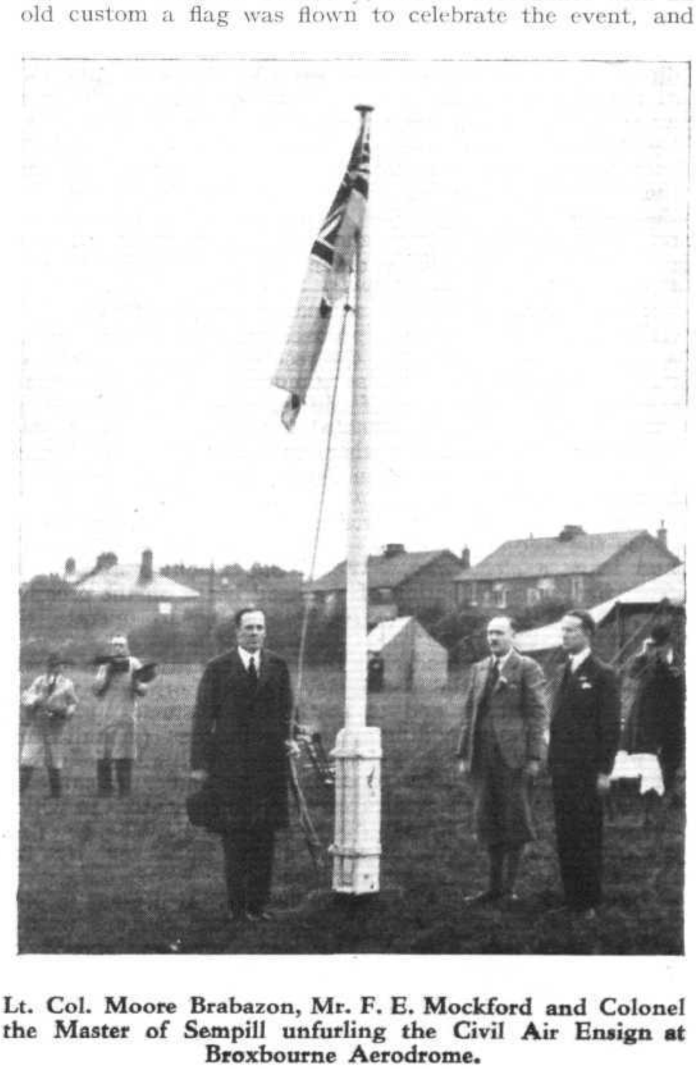
THE HERTS AND ESSEX AERO CLUB.—Last Thursday, September 17, was a flying meeting and the opening day of the General Omnibus Company's Sports Association Flying Club at Broxbourne. There were some thirty aircraft there, and Mr. D. Kinnear, the Club's instructor, gave an aerobatic display on one of the Club's "Redwings." The Club has 1,500 members, who contribute 6d. a week as subscription to the Club.

BROOKLANDS NOTES.—Bad weather has caused a reduction in flying hours during the past week, but despite this, a considerable amount of early morning flying has been carried out. Mr. V. Jillard and Mr. W. Holmes á Court have passed all the necessary tests for their "A" Licences, and are now taking a course in advanced forced landings.

Blind flying is now occupying the times of the two Directors, Messrs. Davis and Jones, who hope to announce a complete course on machines fitted with the latest Reid and Sigrist instruments, in the near future. The cost of this course will be kept as low as possible, and will be announced at a later date.

On Thursday last, Messrs. Jones and Lowdell flew over to the Broxbourne Aerodrome to assist the Frogley brothers in running their very successful Air Meeting. Mr. Jones is probably one of the best announcers at Flying Meetings, and Mr. Lowdell always manages to amuse the crowd by his comic flying turns.

The last brick was laid on the Control Tower of the new Club House on Thursday, and in accordance with an old custom a flag was flown to celebrate the event, and



Lt. Col. Moore Brabazon, Mr. F. E. Mockford and Colonel the Master of Sempill unfurling the Civil Air Ensign at Broxbourne Aerodrome.

indicate to "the powers that be" that drinks were required by the workmen.

A large white circle and the new Civil Aerodrome Ensign make Brooklands look more and more businesslike.

Arrangements are now well in hand to instal a Wireless Transmitting Station for weather reports and flying instruction.

The five-year building programme seems well ahead of scheduled time, and gangs of workmen are to be seen filling up holes in the Aerodrome, taking down old sheds, and erecting modern and up-to-date buildings. Bit by bit the Aerodrome and its amenities are being improved.

THE MARLBOROUGH (N.Z.) AERO CLUB.—This club, which was the first aero club to be formed in New Zealand, and is still one of the leading clubs, as far as activity and enthusiasm are concerned, has its grounds at Woodburne, about five miles out of Blenheim.

The aerodrome is naturally good, and is situated on the broad Wairau Plain, flanked on all sides except the east by high mountains. East of the aerodrome lies the sea and the route across Cook Strait to Wellington. It is small wonder that the grounds are considered to be the best in New Zealand. At present the Club do not own the grounds, but, in view of their sound financial position, it is likely that before long it will do so.

The club has an active membership that is steadily growing, and during the last year two members gained their "B" licences, being the first N.Z. club trained pilots to do so. A further seventeen gained their "A" licences during the year.

During the autumn of each year the Club hold a very successful air pageant, and at the last one there were about thirty machines from all parts of New Zealand present.

The Club encourages its members to go in for cross-country flying, and members have flown across practically all parts of both the North and South Islands of New Zealand, putting in some very creditable flying. Moreover, only one accident has occurred, and that happened to a visitor.

To show the traffic passing through the aerodrome, the following figures are illuminating:—Arrivals, 352; departures, 348. These figures do not include any of the Club's own machines. Moreover, as there are no services across the Cook Strait to Wellington, this indicates that practically all these machines were private ones. As the aerodrome is situated in the northern end of the South Island, all machines crossing the Strait have to report there, and again at Wellington. This ensures a comprehensive check on all inter-island air traffic.

The three machines have, to date, put up a total of nearly 2,000 hours' flying. It is interesting to note that during the year two members of the Club were selected for short service commissions in the Royal Air Force.

CORRESPONDENCE

The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.

WIRELESS WARNING DEVICES

[2767] Wireless control of distant mechanism is well known.

Let each aeroplane have: (1) A wireless transmitter under control of the pilot, but normally in continuous operation during a flight, and sending out in a forward direction a beam wave of not much greater span than that of the aeroplane itself; (2) a receiver tuned to the same wave length as the beam wave; (3) a servomotor linked to the rudder and elevator controls, and actuated by current relayed by the receiver. The linking is such that the servomotor does not override the pilot's control, and that when the servomotor ceases operation the controls return to normal. With such an equipment on all aeroplanes the risk of collision during flight would be lessened, the operation being as follows:—

The beam wave may be compared to a headlight. If it strikes another aeroplane approaching head-on and within a distance, say, of 600 ft., the receiver of the approaching plane is affected, and the servomotor operates the rudder control. Each machine, of course, affects the other similarly, so that both are deflected from their course to starboard and clear one another automatically, the rudder controls returning to normal when the head beams no longer affect the receivers.

Similarly, a machine overtaking from behind would cause the leading machine to swing to starboard (or port) and leave a clear way. Where one machine approaches from the flank the action of the head beam on the crossing machine is to affect the receiver so as to operate the elevator.

It will be understood that the instances given are merely general, and that the idea is developable both with respect to other controls and to stationary obstacles (ground). Known wireless signalling systems comprise: (*a*) indicators in which the variation of electric capacity due to the movement of a foreign body to or from the indicator causes a warning signal in the indicator, and (*b*) indicators in which the movement of a foreign body produces disturbance of an electric field, the disturbance being translated by the indicator into aural or visual signals.

Indicators of both these types are used at present to give warning of the approach of unauthorised persons to forbidden points or areas. The idea, however, should be capable of extension to aeroplane protection.

If the indicator (a) above is sufficiently sensitive to operate at a distance of 600 ft. it could be fitted to an aeroplane, and would then give a warning note or light to a pilot when his machine was approaching too closely to another machine or to any obstacle to air navigation (*e.g.*, a hill in a fog).

Servomotors could, of course, be used to translate automatically the warning into appropriate action, and in this case a machine approaching any obstacle would be deflected right or left to clear it, the pilot returning the machine to its original course when the obstacle was cleared.

With (*b*) above the aeroplane would be enveloped in an electric field extending on all sides to 600 ft. or so. This is readily accomplished with a suitable transmitter, and the entry of another plane or other foreign body into the field produces a warning signal on the indicator.

J. GRAHAM.

London, W.14,
September 11, 1931.

SINGLE COLUMN CONTROL

[2768] FLIGHT of July 17 contains an illustration of a D.H. "Moth," the control system of which is specially designed for a pilot with only one leg.

A control column operates elevator and ailerons in the usual way, but carries a handwheel which rotates to operate the rudder.

Non-standard controls are always interesting, and this particular arrangement especially so. On the face of things it would seem to overcome a common difficulty in the early stages of flying, heaviness on the rudder. Moreover, use of a handwheel for directional control comes naturally to anyone with experience of driving a car, whereas the rudder bar in an aircraft is paralleled by hardly any control unit in a serious conveyance.

On the other hand, the wheel control found in some seaplanes and most large landplanes consists of a wheel rotating on a centre which cannot move laterally. And, further, it controls the relatively insensitive ailerons. Perhaps those pilots who have tried the non-standard system will say whether it makes the use of both hands desirable at most times and necessary at certain times.

Has Capt. Chevalier Willy Coppens' "Moth" got a foot-operated engine throttle? Presumably any objection to a throttle control operating through "push-on" and "push-off" pedals would be based on general considerations, and not on some inherent disadvantage.

"REVS."

Singapore Club,
Singapore S.S.,
August 19, 1931.

Airport News

CROYDON

THIS has been another week when there is little news of interest. The weather was generally good, except on Tuesday and Friday, when slight delays were caused. Friday, in particular, was bad; foggy conditions prevailed for the greater part of the day, but the main services kept to schedule.

There has been a great exit of gold to Holland again this week, and four or five special K.L.M. machines were daily engaged carrying it. Of course, now the gold standard has been suspended, this flow of gold abroad will cease. On Sunday morning, September 20, three K.L.M. machines came in, and were loaded with gold. One of them stood on the tarmac waiting to depart. The incoming Air Union "Goliath" taxied on to the tarmac too quickly, and the top wing caught the wing of the Fokker and damaged an aileron.

On Wednesday, Miss Pauline Gower was at the Aerodrome, and took a great interest in the "Redwings," and she had one up for a trial flight.

The "Monospar" has done several flights during the week, and rumour has it that General Aircraft Company have a very busy time in front of them with the "Monospar" wing.

Surrey Flying Services have purchased another new "Moth," bringing their fleet of aircraft to twelve machines. This firm undertake any kind of work, from joy-riding to special charters. Capt. Muir, one of the partners of this company, went to Paris early in the week to bring back a Potez 32 for Lord Halsbury. This machine has been flown by several pilots during the last few days, and their opinions on its merits vary. During these hard days, and especially when our own British aircraft manufacturers are experiencing a slack period, undoubtedly due to the general slump, it does seem a little out of place for one of our own peers to import a foreign aircraft.

Mr. Rawson, of the Auto Giro Company, has been at Croydon for two or three days with a Mark II "Autogiro." It is surprising how everyone watches this type of machine take off. Mr. Rawson tells us of the new "Autogiro" fitted with three rotors, and without bracing wires. It has a cabin, and cruises at 100 m.p.h., and will do a top speed of 130 m.p.h.

A "Puss Moth" belonging to the Air Survey Company landed on Saturday, and, weather permitting, it is leaving for Uganda on Monday morning.

Imperial Airways had a very busy time on Saturday with joy-riders. One of the Handley-Page W.10's was engaged the whole afternoon and evening on these local flights, the aerodrome being crowded with people waiting their turn. I cannot understand why these joy-riders are not kept in a specified place while waiting. They wander all over the place, and are at times a source of annoyance to the Customs authorities and a danger to pilots themselves. Croydon, after all, is London's Airport, and should be treated more or less as a shipping port. These large parties of visitors seem to think they have every right to do as they please, and do not hesitate to say so. One of these days someone will pay the penalty for their folly.

The traffic figures for the week were:—Passengers, 1,469; freight, 90 tons.

P. B.

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THE WILBUR WRIGHT MEMORIAL LECTURE, 1931

MR. GLENN L. MARTIN, who is a Fellow of the Royal Aeronautical Society, duly delivered his lecture before the Society on Wednesday, September 16, in the Science Museum, South Kensington. The audience was large and distinguished, and appreciated his descriptions greatly. The lecture was an exposition of the manufacturing methods of the aircraft industry of the U.S.A. and of the Glenn L. Martin factory near Baltimore in particular.

Mr. Martin took us through all the troubles encountered in the establishment, lay-out, equipment and working such a factory as his. He worked down from the drawing office showing the method by which the blue prints were distributed to the various departments, how each part was costed and its production planned, how the frequent holding of departmental-head conferences was the means of foreseeing delays in production and of forestalling these, how the factory itself was laid out in such a manner that all material was transported overhead on a universal trolly system which did not interfere with the lay-out of the floor space thus allowing complete alteration of any shop and its fitting should this prove necessary, how even further to assist rearranging the equipment all machine tools were run by separate motors fed from overhead supply lines thus enabling machines to be fed when on any part of the floor. The care with which every part of the organisation was analysed was shown when Mr. Martin spoke of the lengths to which they went when moving their factory from Cleveland to Baltimore. Every possible desideratum of the factory site and its personnel was gone into until the best location was found which most nearly suited all needs. On the detail design side Mr. Martin explained the test they had carried out at his factory to find the most suitable materials for every separate part of each aircraft and then he led us round the shops with the help of a series of lantern slides showing everything from the stores where all the various materials are kept at hand, through the machine, assembly and all other shops to the final erecting shop.

It was an open discourse which should help manufacturers who are on the look-out for aids to efficiency. The lecture will be published in full in the Journal of the Society in due course. Space does not, unfortunately, permit us giving more than this brief résumé in FLIGHT.

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The Prince's Return

ON Saturday, September 19, H.R.H. the Prince of Wales returned to England from his holiday in France. He flew from Le Bourget to Windsor Great Park in the Westland "Wessex" (three "Genet Major" engines), which had been supplied for the tour by the Westland Aircraft Works, of Yeovil. The tour started about the middle of August, when the Prince, piloted by Flt. Lt. Fielden and accompanied by a mechanic named Jenkins, flew to Biarritz, to stay with Lord Ednam. On this outward trip the machine stopped at Le Bourget, where a friend of the Prince was taken aboard with his luggage, and landings were also made at Tours and Bordeaux. These stoppages, together with the unfavourable weather, meant that the journey occupied 6 hr. 40 min. The Prince, however, was not after records. During the stay of the Prince at Biarritz, two flights were made by the "Wessex" to Cannes and back, and one return trip was made to Pau. At Biarrit various local notabilities were gziven flights in the machine, including the president of the Basque Aero Club. The total flying hours of the machine during the whole trip amounted to 30, and during that time there was no mechanical trouble of any sort. Although the engines were only run at about 2,150 r.p.m., and so had plenty of power left in hand, the cruising speed of the "Wessex" never dropped below 100 m.p.h. The parts of France where the "Wessex" has been flying are very international, and the visitors are mostly rich people. They must certainly have been impressed by the quality of the machine which the British Prince had selected. The same "Wessex" is to be at the Bristol garden party next Saturday, and on the following day it will be at Hanworth on the occasion of the visit of the members of the British Association.

Airisms from the Four Winds

Lindbergh Continues

COL. AND MRS. LINDBERGH, who recently completed a flight from New York to Japan in their Lockheed "Sirius" seaplane, left Osaka on September 17 for Nanking, China. On arrival there, Col. Lindbergh cancelled his arrangements, and set about making an aerial survey of the flooded areas in Kiangsu for the Government. On September 21, piloted by Mrs. Lindbergh, he spent about five hours over the area, east of the Grand Canal, obtaining photographs and maps showing the extent of the floods.

Atlantic and Pacific Flyers Safe

AFTER all hope had been abandoned for the safety of the five airmen who, as reported last week, were attempting Atlantic and Pacific flights, all have now been reported safe. Cecil Allen and Don Moyle, who left Tokio for Seattle on September 5, were forced down by storms on an uninhabited island near the Alentians. It appears that they remained stormbound there for seven days and then were able to fly on to a village near Cape Navarin, Kamchatka. They were located by the Russian steamer *Buriat*, which wirelessed a message to Moyle's fiancée, this being relayed to Seattle from the naval station on St. Paul Island.

The Atlantic venture has an even more thrilling ending. Willy Rody, Christian Johansen and Costa Viega, who set out on September 13 from Lisbon in a Junkers machine for New York, had engine trouble shortly after signalling "all's well" to the steamer *Pennland*, 395 miles off Halifax, N.S., and were forced down into the sea. There they remained, drifting helplessly, for six days, until picked up by the s.s. *Belmoira*, about 80 miles off Cape Race. Viega had injured his leg, but the others are unhurt, although exhausted.

Graf Zeppelin's Ninth Atlantic Flight

THE German airship *Graf Zeppelin* left Friedrichshafen at 1.15 a.m. on September 18 for Brazil—its ~~ninth~~ Atlantic crossing and third trip to Brazil. Capt. Lehmann was in command and mails and ten passengers were carried. She passed over Gibraltar at 6 p.m., and over the island of Fernando Noronha at 5.18 p.m. (B.S.T.) on September 20. Pernambuco was reached a few hours later.

Kingsford-Smith at it again

AIR COMMODORE KINGSFORD-SMITH departed from Melbourne on September 21, on the first stage of an attempt to beat existing records for the flight to England; he hopes to accomplish the double journey within 23 days. He is flying a similar Avro "Avian" machine to the *Southern Cross Junior*, called *Miss Southern Cross*.

Mr. Parker Cramer's Machine Found

SOME seaplane wreckage picked up on September 16 by the British trawler *Lord Trent* about 50 miles from Berwick-on-Tweed, has been identified as the Bellanca monoplane in which Mr. Parker Cramer and his mechanic Paquette were attempting a flight from New York to Copenhagen. They had safely reached Lerwick, in the Shetland Islands, but after resuming the flight on August 9 nothing more was heard of them.

A Bleriot High-Speed Prize

IT is reported from France that M. Louis Blériot has founded a prize in the form of a trophy to be awarded to the first man who succeeds in maintaining a speed of 372 m.p.h. for half an hour. It will be held until this time is beaten by 5 per cent. It will become the final property of the man who first achieves a speed of 621 m.p.h. Though obviously only aircraft could win such a prize, the donor has made no stipulation as to the form of vehicle in which the aspirant shall travel.

A "Vildebeest" on Tour

As recorded last week, a Vickers "Vildebeest" Torpedo-Bomber seaplane is making a tour of northern Europe. This machine, piloted by Capt. H. C. Biard, left Southampton on September 20, when it flew to Amsterdam. From here it will visit Copenhagen, Stockholm, Helsingfors, Tallinn, Riga and Memel.

No Cranwell for India

THE Indian Military College Committee, over which the Commander-in-Chief, Sir Philip Chetwode, presided, has recommended that, though a military college on the lines of Sandhurst should be built in India, the cost of erecting a similar training school for flight cadets would be prohibitive. The committee has therefore recommended that Indian cadets should go to Cranwell as heretofore for two years. It also recommended that the Air Ministry be requested to continue the reduced rates for Indian cadets at Cranwell as a temporary measure.

Ban on French Long-distance Flights

FOLLOWING the recent Paris-Tokio flight disaster, in which Le Brix and Mesmin were killed and Doret was injured, the French Air Ministry has placed a ban on other attempts at the long-distance record until the investigation into the above accident has been completed. Furthermore, all machines used for these long-distance flights will, in future, be subjected to an examination by the Air Ministry.

Peter goes Solo

SEPTEMBER 18 was by way of being a red letter day in the de Havilland family. On that day Peter de Havilland, Captain G. de Havilland's second son, who has been learning to fly, "went solo." The eldest son, Geoffrey junior, has, of course, been flying for several years. Congratulations!

The British Gliding Association

THE PRESIDENT, VICE-PRESIDENTS and the CHAIRMAN of the British Gliding Association have arranged to give a luncheon to foreign delegates attending the Conference of the International Commission for the Study of Motorless Flight. Applications may be received from nonmembers. Tickets 5s. each, applications for which must be made to the Secretary before Monday, September 28.

The forthcoming International Gliding Competitions organised by the British Gliding Association, to take place on the Downs at BALSDEAN, near ROTTINGDEAN, on October 3 and 4, have attracted many entries. In addition to the "Wakefield Trophy," the "Manio Cup," the "Volk Cup" and the "Capt. de Havilland Cup," L. G. Sloan, Ltd., have subscribed six sets of Waterman pens and pencils for the events, and Meyrowitz, Ltd., have given a pair of their new pattern "Number Ten" Luxor Goggles with flat safety glass lenses. Further details of the Competitions, etc., can be obtained from the Sec., the British Gliding Association, 44a, Dover Street, W.1.

New Zealand's Girl Pilot

IT is reported from Wellington that Miss Jane Winstone, aged 18, has become the youngest woman to qualify for an air pilot's "A" licence.

Change of Address

THE CIE. GEN. AEROPOSTALE inform us that they have moved their London office to:—French Line House, 20, Cockspur Street, S.W.1. Telephone, Whitehall 3949.

"POTASH AND PERLMUTTER": Two world-famous aircraft constructors caught by the camera as they were enjoying a cabaret show on board the "Homeric" before the Schneider Trophy Contest. We offer no prizes to readers who identify them.

THE ROYAL AIR FORCE

London Gazette, September 15, 1931

General Duties Branch

Pilot Officer on probn. J. W. Martin is confirmed in rank, July 27. The following Pilot Officers are promoted to rank of Flying Officer: Aug. 21:—L. T. G. Barber, W. J. Brighty, H. T. Clark, R. C. H. Crosthwaite, D. McC. Gordon, J. A. Hankins, N. C. Hendrikz, C. A. M. Kyrke-Smith, R. W. G. Love, H. C. O'Loughlin, J. R. Palmer, R. B. Wardman, J. R. Watson. Aug. 28:—E. A. Kayser. Flight-Lt. A. W. B. McDonald continues on half pay, scale "B," during period Sept. 16 to Sept. 25 incl. Lt. M. S. Slattery, R.N., is reattached to R.A.F. as a Flight Lt., with effect from Aug. 8 and with seny. July 1, 1928. Lt. L. G. Richardson, R.N., is re-attached to R.A.F. as a Flying Officer, with effect from Aug. 10, and with seny. Apr. 27, 1925. Lt. F. W. N. Bassett, R.N., Flying Officer, R.A.F., ceases to be attached to R.A.F. on return to Naval duty, Aug. 26. Wing Cdr. T. O'B. Hubbard, M.C., A.F.C., is placed ret., Sept. 13. The short service commn. of Pilot Officer on probn. R. C. J. Rice is terminated on cessation of duty, Sept. 15.

Stores Branch

Wing Cdr. W. F. Bryant is placed ret. (ill-health), Sept. 11.

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

The following Pilot Officers on probn. are confirmed in rank:—R. A. D. Foster, Aug. 27; D. B. Smith, Sept. 1. Flying Officer S. C. Burnley is transfd. from Class A to Class C, Aug. 17; Flying Officer T. J. R. Cornewall-Walker is transfd. from Class C to Class A, Aug. 31. The following Flight Lieuts. are transfd. from Class C to Class B (Stores Branch):—Sept. 7, A. J. Nightingale; Sept. 12, L. R. L. Brown, D.F.C.; D. W. King. Flying Officer J. C. McE. Gibb is transfd. from Class A to the Special Reserve, Aug. 24. Flying Officer A. C. Smith relinqs. on completion of service, July 14.

Stores Branch

The following Flight Lieuts. relinq. on completion of service and are permitted to retain rank; R. Adams, June 17; H. B. Hawker, June 17; J. Roberts, June 17.

AUXILIARY AIR FORCE

General Duties Branch

No. 601 (County of London) (Bomber) Squadron:—E. A. J. Bulwer-Lytton, Viscount Knebworth, to be Pilot Officer, Aug. 25. Pilot Officer the Hon. W. D. S. Montagu is promoted to rank of Flying Officer, Aug. 12. Squadron Leader the Rt. Hon. Sir P. A. G. D. Sassoon, Bt., G.B.E., C.M.G., M.P., resigns on appt. as Under Secretary of State for Air, Sept. 3.

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Air Commodore R. C. M. Pink, C.B.E., to R.A.F. Depot, Uxbridge; 9.7.31.

Wing Commanders: D. Stewart, M.C., A.F.C., to Station Headquarters, Kenley, to command; 1.9.31. C. W. Nutting, O.B.E., D.S.C., to R.A.F. Depot, Uxbridge, on transfer to Home Establishment; 26.8.31. E. R. Pretyman, A.F.C., to Station Headquarters, Hal Far, Malta, to command; 24.8.31. A. T. Williams, O.B.E., to H.Q., Fighting Area, Uxbridge; 24.8.31.

Squadron Leaders: J. W. B. Grigson, D.S.O., D.F.C., to H.Q., Air Defence of Great Britain, Uxbridge; 24.8.31. E. Thornton, to Station Headquarters, Worthy Down; 5.9.31. S. F. Vincent, A.F.C., to No. 41 Sqdn., Northolt; 7.9.31.

Flight-Lieutenants: J. C. C. Slater, to School of Naval Co-operation, Lee-on-Solent; 1.9.31. G. P. Chamberlain, to Station Headquarters, Upavon; 21.7.31. H. F. G. Southey, to Station Headquarters, Upper Heyford; 21.7.31. V. G. A. Hatcher, to Station Headquarters, Duxford; 21.7.31. P. G. Chichester, to No. 216 Sqdn., Heliopolis, Egypt; 20.8.31. K. A. Meek, M.B.E., to Headquarters, Fighting Area, Uxbridge; 24.8.31. W. H. Golder, D.S.M., to Headquarters, Air Defence of Great Britain, Uxbridge; 24.8.31. S. McKeever, D.F.C., to No. 2 (Indian Wing) Station, Risalpur; 17.8.31. C. J. Collingwood, to No. 39 Sqdn., Risalpur; 17.8.31. I. A. Bertram, to No. 1 Sqdn., Tangmere; 31.8.31. J. F. F. Pain, to Headquarters, R.A.F., India, Simla; 17.8.31. H. H. V. Tristem and P. W. Lowe-Holmes, to Armament and Gunnery School, Eastchurch; 1.9.31. I. M. Rodney, to Central Flying School, Wittering; 8.9.31. J. C. E. A. Johnson, to No. 33 Sqdn., Bicester; 6.9.31. W. A. Thompson, to Electrical and Wireless School, Cranwell; 7.9.31. R. J. Legg, to No. 603 Sqdn., Edinburgh; 9.9.31.

Flying-Officers: B. D. Nicholas, to Station Headquarters, Hornchurch; 21.7.31. R. K. Hamblin, to No. 26 Sqdn., Catterick; 21.7.31. T. J. Arbuthnot, to No. 16 Sqdn., Old Sarum; 21.7.31. L. A. Hutchings, to R.A.F. Depot, Uxbridge; 1.9.31. H. A. Constantine, to Central Flying School, Wittering; 7.9.31. G. B. S. Coleman, to R.A.F. Base, Gosport; 5.9.31. C. C. O'Grady, L. R. S. Freestone and H. J. G. E. Proud, to Armament and Gunnery School, Eastchurch; 1.9.31. H. H. Martin, to No. 6 Squadron, Ismailia; 27.8.31. F. A. Wardell, to No. 502 Sqdn., Aldergrove, N. Ireland; 28.9.31.

Pilot Officers: M. A. Payn, to No. 47 Sqdn., Khartoum; 6.8.31. J. W. Martin, to Aircraft Depot, Karachi; 29.7.31. H. B. Wrigley, to R.A.F. Base, Gosport; 5.9.31.

Stores Branch

Flight Lieutenant A. J. Adams, to Station Headquarters, Northolt; 20.9.31.
Flying Officer E. E. Copper, to R.A.F. Depot, Aboukir, Egypt; 12.8.31.

Accountant Branch

Flying-Officer C. E. Hunter, to Station Headquarters, Boscombe Down; 21.7.31.

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AIR MINISTRY NOTICES

AIR MINISTRY NOTICES TO AIRMEN, SERIES A

No. 57 of the year 1931. Carriage of Potassium Chlorate Tablets in Civil Aircraft. (126531/31.)

Attention is drawn to the dangerous nature of potassium chlorate. Tablets containing this substance may be ignited or exploded by rubbing together or by a blow. Such tablets should not, therefore, be carried by the occupants of aircraft.

(September 14, 1931.)

No. 59 of the year 1931. Portsmouth Aerodrome: Restriction of Landing Area. (125395/31.)

Grass-sowing and drainage operations are in progress at Portsmouth aerodrome. The area of work, which covers that part of the aerodrome lying N. of a line running E.S.E.—W.N.W. and passing immediately N. of the landing circle, is not available for use by aircraft.

The N. boundary of the restricted landing area is indicated with boundary markers.

When the wind direction is between N.W. and E.N.E., or between S.E. and W.S.W., landing and taking-off will be unsafe, until the completion of the work, for aircraft other than Avro 504K, D.H. Moth, and similar types.

(September 19, 1931.)

No. 60 of the year 1931. Civil Air Maps of Great Britain. (870838/28

With reference to *The Air Pilot*, Volume I, page 3, section 5, seven new sheets of the ¼-inch Ordnance Survey Map of Scotland (Civil Air Edition) have now been placed on sale.

The sheets of this map now available are numbered 1 to 8 and cover the whole of Scotland with the exception of the Orkney Islands and the Shetland Islands.

The sheets may be obtained, price 2s. 6d. (paper flat) and 3s. 6d. (linen-backed folded) per sheet, through the usual agents or any bookseller.

(September 21, 1931.)

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A MODEL SEAPLANE COMPETITION

THE model seaplane competition for the Lady Shelley Cup was held in Danson Park, Bexley Heath on Saturday, September 19, and was favoured with ideal weather. Before the competition started about a dozen model seaplanes were tuned up on terra firma before more exacting water tests were tried. These preliminaries through, Newell opened the competition by starting his model from the shore into a gentle breeze. The model taxied for a yard or so and then rose and climbed rapidly to a good height over the lake, finally alighting on the water after a flight of 43 seconds. A. M. Willis got his model away nicely. It taxied out and took off very gently and flew back over the land, causing some anxiety by hugging a belt of trees; however, the model cleared these and made a good landing—time, 48 seconds. Some competitors experienced trouble in getting their models to leave the water and one or two models turned turtle. Dent gave an exhibition of high-speed flying, his model appeared to "open out" as it left the water and delighted the spectators by its pace and sharp turns. A. M. Willis got in a very fine flight of 64.2 seconds. This time the model managed to dodge the trees and passed out into the open country; however, the timekeeper followed it up and kept it in sight until it landed. A. T. Willis using a 13-oz. plane managed to get his model off the water after it had taxied a considerable way. Newell, meanwhile, had completed his sixth flight, his model lodging up in a tree for the fourth occasion, this time after flying for 52 seconds. A very successful and interesting competition came to its conclusion with some spectacular flights by Messrs. A. M. and A. T. Willis, Dent and Cook.

Result.

1st	A. M. Willis, T.M.A.C.	64·2 secs.
2nd	T. H. Newell, T.M.A.C.	52 ,,
3rd	D. M. Dent, T.M.A.C.	24 ,,

AIRCRAFT COMPANIES' STOCKS AND SHARES

CONDITIONS in the stock and share market were naturally overshadowed towards the end of September by the suspension of the gold standard. Sufficient time has not elapsed at the time of writing to judge the effect of this decision on the Stock Exchange, but it cannot be without significance that dealers are hopeful that before long public interest will increase, although, of course, some fluctuations in prices are to be expected before things settle down to the new conditions. Readers will have noticed that the consensus of expert financial opinion is that the suspension of the gold standard is likely greatly to stimulate the country's industries. As was to be expected, the shares of aircraft and allied companies have not escaped the general downward trend of prices of industrial shares in the past month; but they have not experienced very heavy selling, although several dividend announcements have proved disappointing. The decision to pass the interim dividend of D. Napier & Son (5 per cent. was paid last year as an interim) was not altogether a surprise, for, as was mentioned here last month, the market was prepared for a reduction. If current reports that the company contemplated making an offer for Bentley Motors is correct, it would presumably be a reason for conserving resources, but, apart from this, the uncertainty of the general outlook has led the boards of a large number of companies to defer all decision regarding ordinary dividends until the full accounts for the year are available. The Napier decision has an adverse influence on Fairey Aviation and de Havilland shares, for, as neither of these companies pays interim dividends, there will be no official indication of progress during the current year until their reports are published. Each company's year ends this month, and the reports usually appear about the end of December. As in the case of D. Napier, the present price of Fairey Aviation and de Havilland shares appears to discount more than a moderate "cut" in dividends; it is not, therefore, surprising that better support has been forthcoming for these shares at the low prices now ruling. Rolls-Royce are also down practically to the lowest price so far touched this year. Little interest has been shown in Imperial Airways, pending the issue of the report. As was mentioned here last month, the market appears to hope that the dividend will be maintained. Ford Motors have also shared in the marking down of values, and in other directions British Aluminium fell sharply on the absence of an interim dividend. Triplex Safety Glass have been a firm spot, thanks to the decision to raise the dividend from 5 to 10 per cent. The company has obviously reaped benefit from its policy of increasing production and lowering prices. Vickers were again active on tariff hopes. National Flying Services have been neglected; the report falls to be issued in October. Joseph Lucas have remained under fears of a "cut" in the distribution, but have been a better market. Brown Brothers failed to benefit quotably from the maintenance of the interim at 2½ per cent. "Shell" have been very weak, in common with other leading oil shares; the present price discounts a very large reduction in the dividend.

Name.	Class.	Nominal Amount of Share.	Last Annual Dividend.	Current Week's Quotation
			%	
Anglo-American Oil	Deb.	Stk.	5½	100
Armstrong Siddeley Develop...	Cum. Pref.	£1	6½	14/4½
Birmingham Aluminium Castg.	Ord.	£1	7½	18/–
Booth (James), 1915	Ord.	£1	15	38/6
Do. do.	Cum. Pref.	£1	7	20/3
British Aluminium	Ord.	£1	10	21/3
Do. do.	Cum. Pref.	£1	6	18/9
British Celanese	Ord.	10/–	Nil	4/–
British Oxygen	Ord.	£1	8B	11/10½
Do. do.	Cum. Pref.	£1	6½	19/10½
British Piston Ring	Ord.	£1	22½	26/3
British Thomson-Houston ..	Cum. Pref.	£1	7	22/3
Brown Brothers	Ord.	£1	10	21/10½
Do. do.	Cum. Pref.	£1	7½	22/6
Dick (W. B.)	Cum. Pref.	£10	5	116/3
De Havilland Aircraft ..	Ord.	£1	5	13/1½
Dunlop Rubber..	Ord.	C	6	14/9
Do. do.	"C"Cum.Pref.	16/–	10	13/9
En-Tout-Cas (Syston)	Def. Ord.	1/–	Nil	1/–
Do. do.	Ptg. Pfd. Ord.	5/–	8	3/1½
Fairey Aviation	Ord.	10/–	7*	11/10½
Do. do.	Ist. Mt.Deb.	Stk.	8	106
Firth (T) & John Brown ..	Cum. Pref.	£1	6D	7/6
Do. do.	Cum. Pref.	£1	5*D	8/6
Ford Motor (England).. ..	Ord.	£1	10	35/–
Fox (Samuel)	Mt. Ptual. Deb.	Stk.	5	71½
Goodyear Tyre & Rubber ..	Deb.	Stk.	6½	99½
Handley Page	Ptg. Pref.	8/–	12½	11/–
Hoffmann Manufacturing ..	Ord.	£1	Nil	16/–
Do. do. ..	Cum. Pref.	£1	7½	15/–
Imperial Airways	Ord.	£	5	12/6
Kayser, Ellison	Ord.	£5	6	50/–
Do. do.	Cum. Pref.	£5	6	73/9
Lucas (Joseph)	Ord.	£1	25	48/9
Napier (D.), & Son	Ord.	5/–	15	5/7½
Do. do.	Cum. Pref.	£1	7½	24/4½
Do. do.	Pref.	£1	8	22/6
National Flying Services ..	Ord.	2/–	Nil	–/4½
Petters	Ord.	£1	6	20/–
Do.	Cum. Pref.	£1	7½	18/9
Roe (A. V.) (Cont. by Armstrong Siddeley Devel., *q.v.*)	Ord.	£1	—	—
Rolls-Royce	Ord.	£1	10	27/6
Smith (S.) & Sons (M.A.) ..	Def. Ord.	1/–	18¾	1/–
Do. do. ..	Ptg. Pfd. Ord.	£1	12¼	10/–
Do. do. ..	Cum. Pref.	£1	7½	10/–
Serck Radiators	Ord.	£1	17½	30/–
"Shell" Transport & Trading	Ord.	£1	17½*	29/4½
Do. do.	Cum. Pref.	£10	5	£9½
Triplex Safety Glass	Ord.	£1	10	26/3
Vickers	Ord.	6/8	8	7/6
Do.	Cum. Pref.	£1	5*	18/–
Vickers Aviation (Cont. by Vickers, *q.v.*)	—	—	—	—
Westland Aircraft (Branch of Petters, *q.v.*)	—	—	—	—
Whitehall Electric Investmts.	Cum. Pref.	£1	7½	22/9

* Dividend paid tax free. B Rate per annum for nine months.
C £1 unit of stock. D Last xd. on March 19.

NEW COMPANIES REGISTERED

AERO MOTOR SPIRIT CO., LTD., 235, Westminster Bridge Road, S.E.1.—Capital £2,000, in £1 shares. Distillers, manufacturers and distributors of petroleum or petroleum products, etc. Directors:—H. Moorcroft (chairman), The Old Mint House, Upper Gatton, Reigate, oil importer (director of Triumph Petrol Co., Ltd.); J. H. Simpson, St. Albans House, Dartford, motor spirit distributor, and service station proprietor (director of Rippleside Service Station, Ltd.).

BRITISH EXPERIMENTAL PROJECTOR ADVERTISING CO., LTD., 41, Frederick Street, Birmingham.—Capital £200 in £1 shares. Objects, to carry on the business of aerial advertising and publicity agents and specialists, by means of balloons, dirigibles and aircraft generally, etc. Directors: F. M. Wharton, 74, Stanmore Road, Edgbaston, Birmingham (director and works manager of Hall Street Metal Rolling Co., Ltd.), H. W. Peters, "The Bungalow," Davehouse Lane, Solihull (director H. W. Peters and Co., Ltd.)

LONDON AERO PISTON CO., LTD.—Capital £100 in £1 shares. Manufacturers of and dealers in pistons, repairers of motor vehicles of all kinds, manufacturers of and dealers in aerial conveyances and aircraft of all kinds, etc. Directors:—W. Paddon, 4, Craven Park Road, N.W.10, mechanical engineer, and D. W. Gosschalk, 8, Essendon Road, Sanderstead, gent. Solicitors: Hicks, Arnold and Bender, 25, Southampton Street, Strand, W.C.2.

AERONAUTICAL PATENT SPECIFICATIONS

(*Abbreviations*: Cyl. = cylinder; i.c. = internal combustion; m. = motors
The numbers in brackets are those under which the Specification will be printed and abridged, etc.)

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